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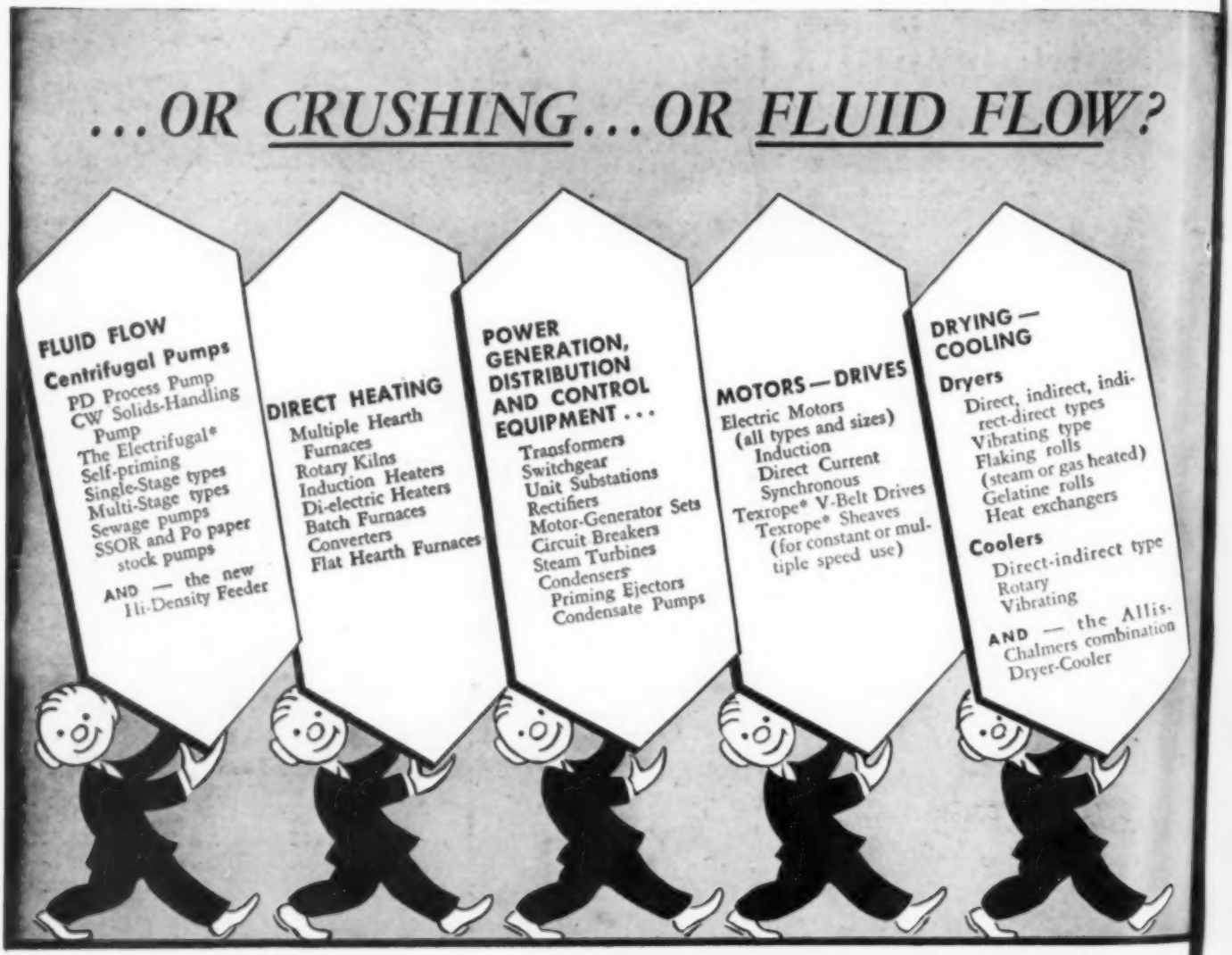
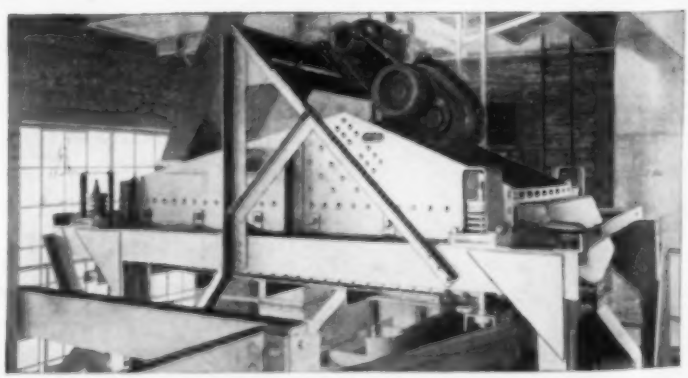


"Low-Head" Screen

WIDELY USED in chemical processing, the *Low-Head* vibrating screen operates horizontally . . . requires a minimum of headroom. Single deck 4 by 10 ft Allis-Chalmers unit is shown at right, installed. The *Low-Head* screen has been successfully adapted for handling hot materials of 175 to 400°F. Welded parts are "stress-relieved" for lasting strength. Sizes 3 by 6 to 6 by 16 ft. Described in Bulletin B6330.



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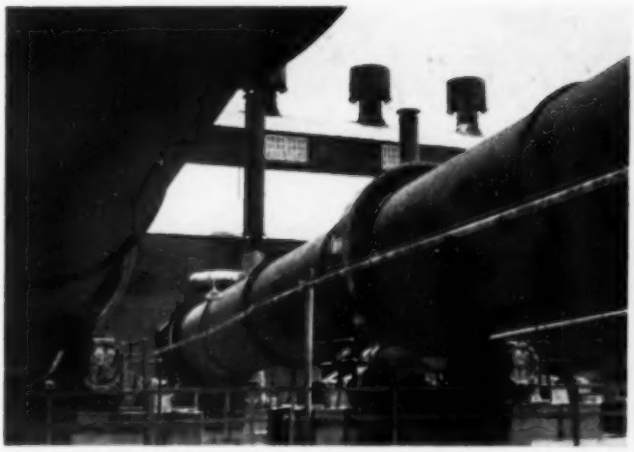
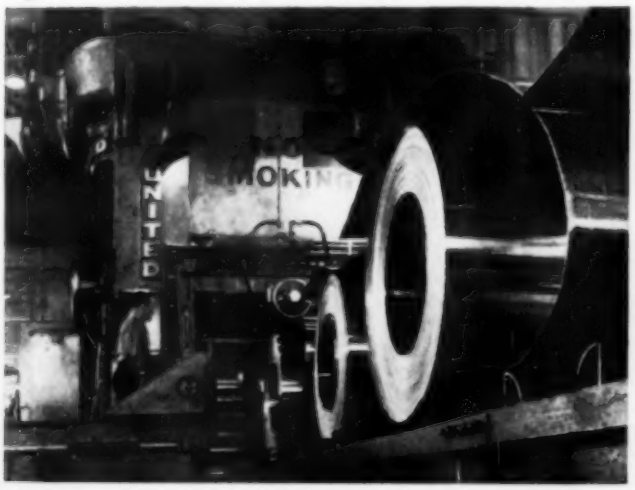


2. It isn't alumina yet—but this view in the Baton Rouge plant shows the final step in processing. These giant rotary kilns operate at 1800 degrees F., and cook the alumina hydrate into snow-white alumina powder. This alumina is then loaded into box cars and goes by rail to Permanente Metals' reduction plants at Spokane and Tacoma, Washington, where it is converted into basic aluminum.

3. Spokane, Washington, is the home of the reduction plant of The Permanente Metals Corporation, where alumina is made into basic aluminum. Another reduction plant, at Tacoma, increases the supply needed to keep the Spokane rolling mill operating at capacity. Reduction process requires tremendous power. Metal is cast into pure aluminum pigs, then sent to rolling mills for remelting and alloying.



4. The rolling mill at Spokane is capable of producing more than 288 million pounds of aluminum yearly. Two-ton ingots of alloyed aluminum are hot-rolled into long strips. Cut into sheets, the metal is cold-rolled to proper specifications (above). Careful handling and constant testing assure outstanding quality. This plant comprises 53 acres. Plate, sheet and strip are loaded directly into cars for shipping.

5. Here's why Kaiser Aluminum is in demand: Permanente Metals' representatives really give service. Delivery promises are kept. Quality exceeds specifications. Top technical brains are always at your service, may cut your costs through sound advice. Though Permanente Metals itself is but one year old, its administrators, engineers and operators have had years of experience in the aluminum industry.

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WATCHING WASHINGTON

R. S. McBride, EDITORIAL CONSULTANT
Donald O. Loomis, WASHINGTON CORRESPONDENT

Continued Army control of some ammonia facilities delays conversion of plants to production of methanol . . . Protest procedure outlined if tariff cuts under trade agreements prove injurious . . . Government finances program to increase domestic consumption of silk as aid to Japan. . . . Charge against corn refiners is step by FTC to outlaw basing points and all forms of delivered pricing. . . . Chemical consumers of natural gas warned to expect cut-offs when cold weather brings shortages . . . World chemical survey covering 1940-46 soon to be released

Army Hangs On

RELEASE of nitrogen fixation plants from Army control was expected before now. But military authorities have decided to retain under Army control Cactus Arsenal and Ohio River Arsenal. Present operators are Spencer Chemical and Allied Chemical; but these firms will not have a chance under present policy of getting commercial leases of these properties. The two are in the same status as Morgantown, that is retained as military reserve facilities.

It is expected that these three plants will be operated to make ammonium nitrate. Probable destination of the product will be areas of occupation in Japan and Germany. Since the product so handled remains in Army control, it is not eligible for assignment under the program of International Emergency Food Council. This fact accounts in part for the inadequacy of nitrogen available for assignment to different countries in the world fertilizer program announced by IEFC for the fiscal year 1947-48.

Methanol Still Scarce

CONTINUANCE of Army control of some ammonia facilities means that commercial operators of other ammonia plants will not find it practical to convert from ammonia to methanol as fully as expected a few months ago. Several ammonia operators had scheduled extensive production of methanol on a scale not now likely.

This failure of methanol supply to develop during the present year will be reflected in continued shortage of solvents and anti-freeze. Replacement of ethyl alcohol by methanol will, of course, be delayed in many other applications also.

Du Pont to Build?

WASHINGTON has listened with interest, and some confidence, to the statement of Senator Eastland that a large ammonia plant is to be built in the southern part of his state, Mississippi. Apparently the Senator sought to publicize a proposed Du Pont plant intended to become "the largest synthetic ammonia works in America."

Washington could not get promptly any confirmation from Wilmington. But greater confidence in the statement was given by the contemporary report which was confirmed, at least informally, that Mathieson Alkali had sold all of the Lake Charles output to Du Pont for at least a two-year period. This, official Washington believes, is evidence that Du Pont is aggressively re-entering the fertilizer ammonia and urea markets from which it had partially withdrawn during the past season.

Both industry and government agencies in the Capital agree that nitrogen for fertilizer may be a bit more scarce this fertilizer year than it was in the year which ended in June. As one industry observer put it, "We still do not need salesmen, but we urgently need customer pacifiers."

Escape Rules Fixed

TRADE agreements cutting tariffs are to include from now on a safeguard clause permitting modification of an agreement when a domestic producer can prove "injury or serious threat thereof." U. S. Tariff Commission has adopted and made effective a set of rules of procedure under which one wishing to protest flexible tariff provisions may initiate and prosecute his case.

Among the important factors which a protestant must discuss are amount of direct labor affected by imports; relation of income from sales to the total business of applicant; comparability of domestic and foreign competitive products; geographical areas involved; full definition of the influence on prices, costs, and wages in each commodity case. Hearings will, of course, be held as a part of each formal proceeding.

U. S. Promotes Silk

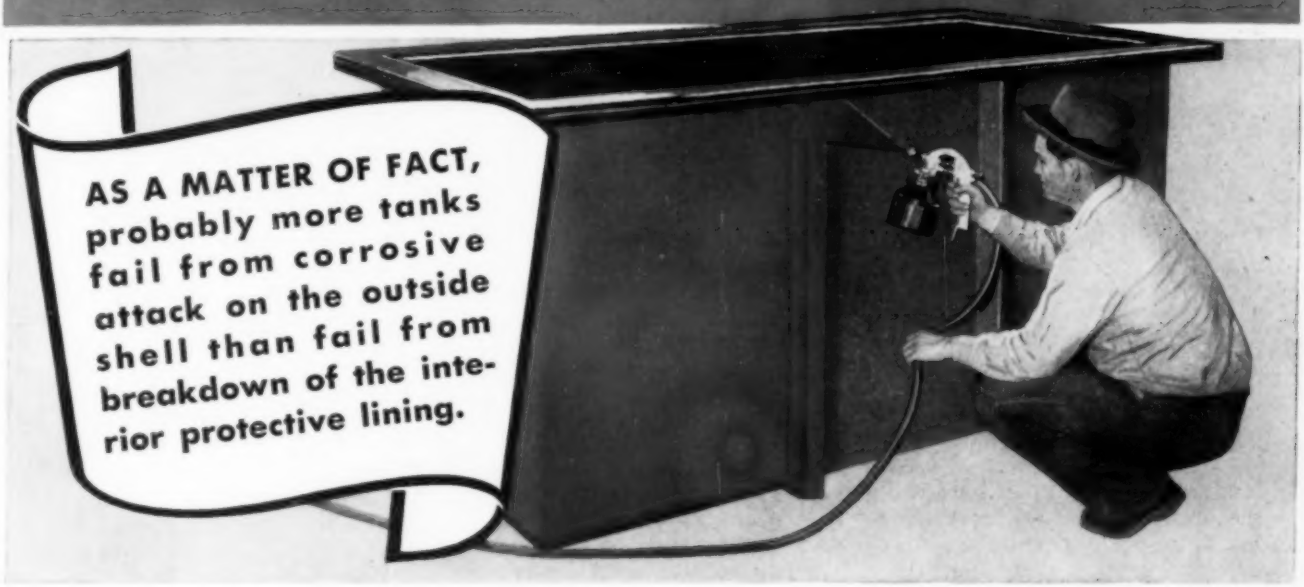
THE government is financing a program to sell America more of Japan's growing stockpile of raw silk. U. S. Commercial Company, an RFC subsidiary which markets the exports of occupied countries, has contracted with the International Silk Guild for an advertising and research program to sell more silk to the consumer and to industry. The Guild also will undertake research to improve the silk fiber, perhaps by chemical treatments to overcome some of its weaknesses. Already USCC has urged tire manufacturers to study silk for use in airplane tire cord, and has turned over to them specially-treated silk for test purposes.

Financing of the program comes from two sources. Buyers of 300 bales of selected assortments of silk have been getting a 25 percent discount over buyers of individual lot quantities. Now their differential will be 22½ percent, the remaining 2½ percent being earmarked to support the Silk Guild's program. Additional costs of the research and promotion will be met from War Department funds derived from sale of raw silk.

USCC officials concede that bringing silk back to the American market in any quantity is going to be difficult. Mrs. America likes synthetic yarns, and she showed her preference before the war when silk still was available. American industry also has

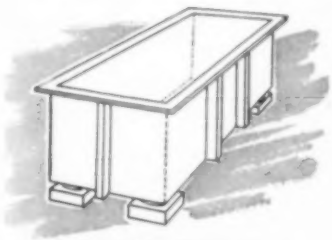
Tank Failure

IS NOT ALWAYS AN "INSIDE JOB"


AS A MATTER OF FACT, probably more tanks fail from corrosive attack on the outside shell than fail from breakdown of the interior protective lining.

WHETHER you line your tanks with rubber, plastic, brick, tile or lead, be sure the outside is adequately protected from acid spillage, condensation, fumes, and moisture.

HERE'S HOW:



1st—Wherever possible see that tanks are installed with adequate air space underneath, and that all exterior surfaces are accessible for cleaning.

2nd—Coat all exterior surfaces, *including the bottom,* with Tygon Corrosion-resistant Paint—the *all-plastic* coating resistant to acids, alkalies, oil, water and alcohols. Don't be stingy. Do the job properly. Apply a coat of Tygon Primer, and three coats of Tygon Paint. The cost shouldn't exceed 20c per square foot, including labor and materials.

3rd—Clean and inspect the outside shell occasionally. The glossy Tygon surface cleans easily. If you find a scratch or break in the film caused by carelessness, touch it up with fresh Tygon Paint. The job will be as good as new.

Facts About—

TYGON PLASTIC PAINT

You'll Want To Know

- *May be applied to metal, wood or concrete*
- *Air dries within an hour*
- *Resists acids, alkalies, oils, grease, alcohols and water*
- *Non-oxidizing, will not craze, chalk, check or flake-off*
- *Flexible, tough, resists impact*
- *High dielectric strength*
- *Available in colors: white, black, gray, red, green, aluminum and clear*

PROCESS EQUIPMENT DIVISION

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Akron 9, Ohio

found synthetic fibers like nylon and rayon vastly superior for industrial uses because of standardized high quality. Both the individual consumer and the industrial user like the lower price of synthetics.

However, the Army sees the program as one way of building up dollar exchange in Japan to help defray the costs of occupation. The Army also knows that the Japanese will one day have to be on their own, economically, and they'll need a market for their exports to provide at least a minimum of dollar exchange.

U. S. Agricultural Research

In the coming months, chemical processors will watch with interest the announcement of research projects approved by the Department of Agriculture under the Research and Marketing Act of 1946. The Department has been engaged since the bill's passage last year in preparing for the day when funds would be available to implement the law's purpose. Now that Congress has voted an appropriation, specific projects are likely to be launched in rapid-fire order.

Industry advisory committees for commodity groups have recommended suggested areas for research and specified which of them rates the highest priority. It is now up to the National Advisory Committee, and finally the Secretary of Agriculture, to specify the particular projects to be undertaken and to allocate the funds necessary. Advisory committee reports have leaned heavily toward recommending economic research in marketing, consumer education, product improvement, etc., and less heavily toward recommending technologic research.

However, for many agricultural commodities the problem of marketing increased production leads directly to converting farm products through processing into raw materials of greater use to industry. For example, the dry bean and pea committee calls for investigation into the chemical properties of the products, and notes that investigations have indicated that proteins from peas and beans have promise in the field of plastics. Second priority of the tree nuts advisory committee is to technological utilization of nuts, including processing for oil and other chemical research, and the use of byproducts (hulls and shells) in production of chemicals and several other industrial uses. Citrus fruit advisory committee cites several fields in which research would point the way to new chemical and industrial uses of citrus fruits byproducts.

All in all, the 20-odd industry advisory committees will bring forward similar suggestions involving research of interest to the chemical field. As of the middle of last month, the House had voted $9 million for research under the Act, and it was not likely that the Senate would vote less than this amount. The Act itself authorizes annual appropriations up to as much as $20 million in 1951.

FTC Hits Corn Refiners

The Federal Trade Commission has hit the corn products refining industry again. This time FTC charges 19 companies, producing 95 percent of all corn products sold in the U. S., with conspiracy to fix prices. This new complaint is another step in FTC's drive to outlaw the use of basing points and other forms of delivered pricing.

In a previous case against two corn products refiners, FTC won a Supreme Court decision which found the companies guilty of discriminating in price between like purchasers of their products. FTC's evidence in this earlier court battle centered around the different mill net return which the companies got by selling only at a delivered price.

Since this first corn products case was won, however, FTC lost a decision in the circuit Court in the so-called Cement Institute case. That case, now pending before the Supreme Court, was based on collusion—rather than price discrimination—but it was thrown out because the court said FTC hadn't proved its charges. The new complaint against the 19 corn products companies, seen in this light, is viewed as an attempt by FTC to prepare for a possible adverse decision from the Supreme Court in the Cement Institute case this fall.

The 19 companies are charged with collusion and a dozen different kinds of activities are listed in support of such charges. By "throwing the book" at the industry, FTC will make the basing point and delivered price systems in themselves only part of the evidence, rather than trying to prove that such systems in themselves are evidence of collusion.

Fiber and Paper Studies

Representatives of Tariff Commission, Forest Service, Bureau of Agricultural Economics, Southern Regional Research Laboratory, and National Cotton Council have prepared a report entitled "Production Studies on Synthetic Fibers and Paper." This study is one of several projects in a comprehensive fact-finding program on the agricultural and economic problems of the cotton belt. The report was to be submitted to the Cotton Subcommittee of the House Committee on Agriculture early in July, and should be available in printed form from the Government Printing Office.

Gas Allocations

Natural gas supply will be much less than adequate to meet the needs in various areas of the country when cold weather comes. Federal Power Commission is taking account of this fact and seeking to encourage service rules which provide for fair allocation of deliveries among the customers of pipeline companies. The rules approved for Natural Gas Pipeline Co. of America are the first attempt to establish distribution among would-be customers of Nebraska, Kansas, Illinois, Iowa, and Wisconsin.

Also aggressively studied by Federal Power Commission has been the order governing Panhandle Eastern Pipeline Co. emergency service rules. Non-discriminatory service is sought for a system capable of moving 425 million cubic feet daily to meet known demands already exceeding 518 million. In this particular case, inadequacy of compressor and loop-line facilities are recognized as serious bottlenecks.

Natural gas users among chemical process industries are being warned privately to expect cut-off when cold weather makes natural gas inadequate to meet both house heating and industrial needs.

To Limit Authority

Federal Power Commission has recommended to Congress that its authority be limited under certain conditions. It wants clearly defined the fact that FPC does not regulate intrastate business of local distributing companies which supply gas from regulated pipelines. It proposes that the definition of authority be clarified to this effect by re-definition of some of the important terms in the law, and also those which relate to production, gathering, and transportation.

It has been suggested that FPC authority should be limited also to preclude Commission supervision of industrial users of natural gas in their intrastate business, even though the supplier is a regulated pipeline.

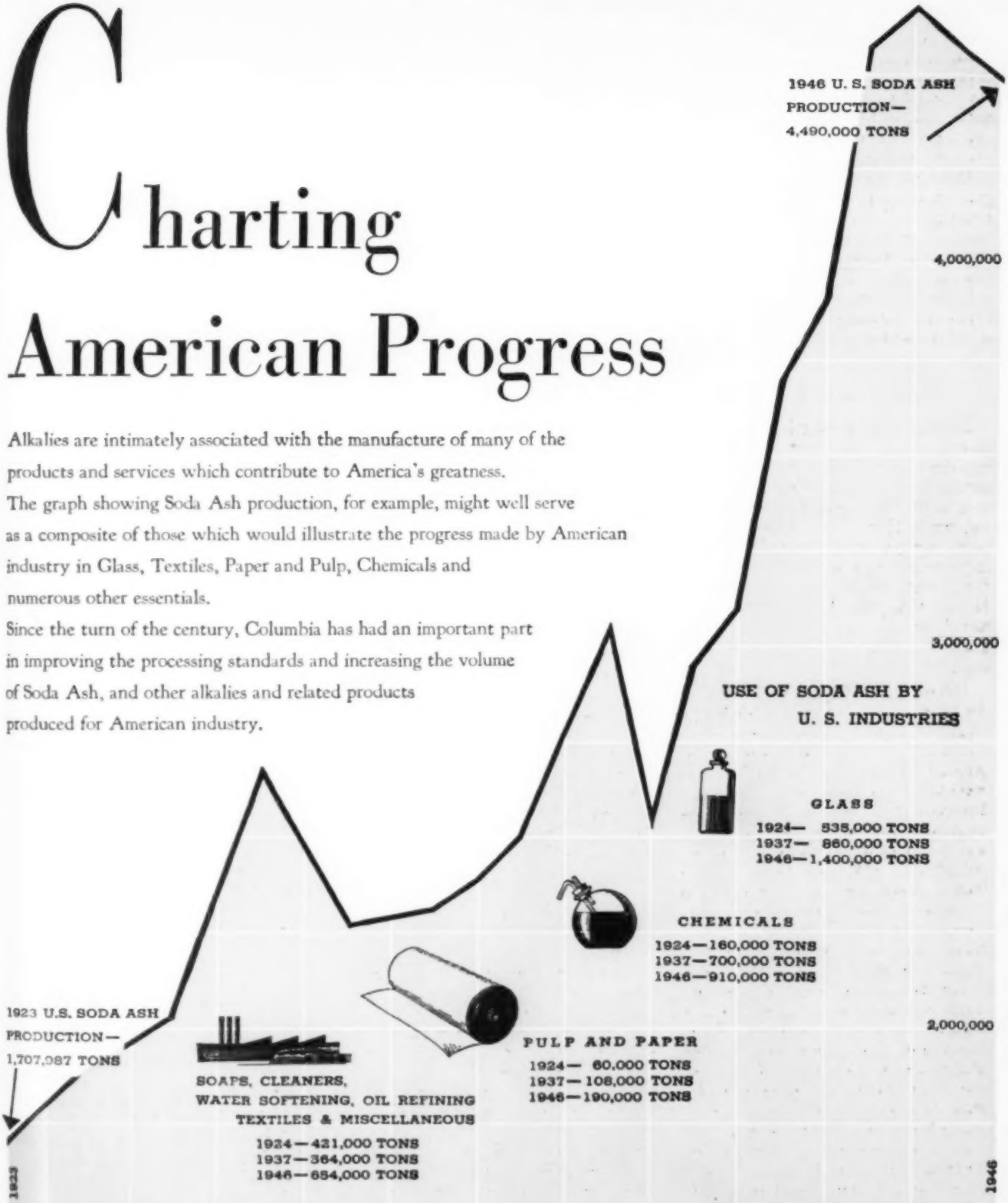
More Safety Work

Congress finally decided that the safety studies in the Division of Labor

Charting American Progress

Alkalies are intimately associated with the manufacture of many of the products and services which contribute to America's greatness. The graph showing Soda Ash production, for example, might well serve as a composite of those which would illustrate the progress made by American industry in Glass, Textiles, Paper and Pulp, Chemicals and numerous other essentials.

Since the turn of the century, Columbia has had an important part in improving the processing standards and increasing the volume of Soda Ash, and other alkalies and related products produced for American industry.



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Soda Ash • Caustic Soda Liquid Chlorine • Sodium Bicarbonate • Pittchlor and Pittcide (*Calcium Hypochlorites*) Silene EF (*Hydrated Calcium Silicate*) • Calcium Chloride • Soda Briquettes (*Iron Desulphurizer*) • Modified Sodas • Caustic Ash Phosflake (*Bottle Washer*) Calcene T (*Precipitated Calcium Carbonate*)

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Standards should be continued and granted funds equal to last year. Thus, this program under R. P. Blake will continue both fundamental engineering investigations as to proper safety methods and extensive educational and cooperative work in industry.

Safety code formulation probably will go on, to the extent later determined, largely in cooperation with National Bureau of Standards and Industry. Independent code work appears rather unlikely at the Labor Department because funds available are not adequate for that purpose. Final decision in these code matters remains for the future, but the prospect is for cooperative undertakings only.

Republican Record

THE Republican Congress was winding up its first session last month preparatory to keeping an end-of-July deadline set by the Reorganization Act passed last year. Whether or not the session was extended to rush through last-minute "must" legislation, the bulk of the record was on display.

The Taft-Hartley labor bill—the first drastic revision of the labor law since the enactment of the Wagner Act. The new law puts even more government into labor relations, adds more management "rights" to counter-oppose many "rights" granted labor and labor unions under the 1937 Wagner Act. Passed over the President's veto, this law will require months of clarification in actual operation and in the courts before its final impact on industrial relations can be known. Republicans conceded at the outset that it would require revision. They've set up a joint Congressional committee to study its operation, recommend changes as they are needed.

Rent control—Virtual end of remaining restrictions on non-housing construction was included in the law, signed "reluctantly" by President Truman, which extended rent controls to the end of February, 1948. Industry is now free to push expansion and modernization plans without first getting consent of Washington officials. Only ban remaining is on amusement and recreation building, and then only if materials are in short supply.

Reconstruction Finance Corp.—This agency's life was extended to June 30, 1948. However, a $2 billion limit was put on its lending power, and RFC now can't loan money to foreign governments, other government agencies, or anyone else who can obtain capital from private sources. RFC can still buy surplus property for resale to small business.

Alcohol plants—Congress extended to April 1, 1948, the period during which alcohol plants may produce sugars and syrups simultaneously with alcohol.

Portal-to-Portal—This law wiped out all past wage claims not based on custom or contract, exempted employers from liability when they've followed in good faith government wage-hour regulations and interpretations, and placed a two-year statute of limitations on all future wage-hour actions. The portal-to-portal boom thereupon busted.

Tin smelting—Authorization was given to Reconstruction Finance Corporation to continue its promotion of tin production and smelting. Tin smelting plant at Texas City will continue to process tin concentrates to expand still-short tin supply.

Tankers—World petroleum snarl was avoided by last-minute continuation of Maritime Commission's authority to operate tankers.

Rubber—Government dropped its role as only U. S. buyer of natural rubber in world market but Congress okayed continued allocation authority to force use of synthetic along with natural rubber. Authority ends March 31, 1948, but it's likely to be extended again if Congress by that time hasn't formulated a permanent national rubber policy to fix place of synthetic rubber.

National Science Foundation — Passed in final form which provides for 24 members with power to select their own salaried director. Question of patent rights growing out of research not covered in bill.

Science Foundation

RECEIVING Congressional approval on July 22, the bill to establish a National Science Foundation provides that the newly-created body succeed the wartime Office of Scientific Research and Development. Work of the Foundation, will be broadened in scope so as to include practically all fields of science. The President will appoint 24 members, each one eminent in the fields of the fundamental sciences, medical science, engineering, education or public affairs. Membership is subject to Senate confirmation. Duty of the members will be to promote basic research by grants, loans, scholarships and other help to organizations, institutions, and individuals.

The bill further provides that the Foundation carry out research which involves national defense. It makes provision for maintaining a register and in other ways become a clearing house for information covering scientific and technical personnel in the United States and its territories and possessions.

Before final passage, opposition centered in two amendments which had been in the Senate version and which were eliminated by the joint conference committee. One of these was the proviso that 25 percent of all funds granted for research at institutions must be allocated to state-supported colleges and universities which met the specified requirements. The other moot point was concerned with the appointment of a director, a position which carries a yearly salary of $12,000. The Senate measure had stipulated this appointment be made by the President and be approved by the Senate.

The bill was adopted in the form agreed upon in joint conference so the state-supported institutions are given no preference in allocation of funds and the Foundation, after Presidential appointment of members, will be free to effect its organization and select its own director.

World Chemical Survey

A GOVERNMENT report on the wartime development and postwar status of the chemical industries in the major chemical producing and consuming countries is being prepared for release within the next few weeks. "World Chemical Developments—Part I" will cover the years 1940-46, bringing up-to-date the annual reports of the Chemical Division of the Office of Domestic Commerce which were suspended during the war.

Part I will cover recent developments, production, foreign trade figures, etc., for all the countries of Europe (except Germany), and the major countries of the British Commonwealth. Part II, which is to be published separately at a later date, will report on the remaining countries, that is, South America, the Far East, and Germany.

The survey is expected to provide in a single volume a handy reference to each country's chemical position and provide a comparison with the U. S. industry's own production and foreign trade activities during and since the war. When available, it will be on sale at the Superintendent of Documents, Washington, D. C.

Chemical Data Index

CHEMICAL economists, and market research executives will find a useful key to government data on chemicals in the new "Chemical Statistics Directory No. 1," published last month by

As the white outline indicates, a standard unit of much greater frame size would be required to do the work of Speedaire.

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WITH a very restricted space to accommodate the speed reducer, a rubber company selected Speedaire to drive this new mill. A standard worm gear unit of equal capacity would have occupied over 60% more space.

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Speedaire is Cleveland's new fan-cooled worm-gear speed reducer. Because it is fan-cooled, Speedaire will do more work—will deliver up to *double the horsepower* of standard worm units of equal frame size, at usual motor speeds. It can be installed economically on many applications where other types have been used heretofore—giving you the advantages of a compact right-angle drive. Speedaire gives the same long, trouble-free service characteristic of all Clevelands.

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Speed Reducers

the Chemicals Division of the Office of Domestic Commerce. The 64-page publication provides an index to 38 different kinds of figures on several hundred commodities published in 141 different government publications. The directory indicates for each chemical commodity, through the use of symbols, what government publication has the statistics, what page of the publication they're on, and what kinds of data are to be found for the commodity.

Among the kinds of figures covered are production, imports, exports, sales, shipments, stocks, prices, wages, hours, employment, etc. (Not all these figures are available for each chemical listed, of course.) The statistics indexed are exclusively those published by the government, either government-collected or obtained from private sources. The nomenclature followed is that of the "Standard Commodity Classification" of the Bureau of the Budget. The new directory covers data published during the year 1945, plus selected data from earlier years, including the 1939 Census of Manufacturers. It's on sale by the Superintendent of Documents for 15 cents per copy.

Trucking Chemicals

MANUFACTURERS and shippers of many kinds of chemicals are studying the Interstate Commerce Commission's redraft of its rules and regulations governing truck transportation of explosives and other types of commodities designated as dangerous. Informal conferences already have been held on Parts 1 to 6 of ICC's "Motor Carrier Safety Regulations" covering general regulations on truck operation. The first draft of Part 7, released last month, is of specific interest to the chemical industry. Its complete title is "Rules and regulations governing the transportation of explosives and other dangerous articles by common and contract carriers of passengers and property, private carriers of property, by motor vehicle."

The rules and regulation will cover the shipping, packaging, and handling of explosives, inflammable liquids, inflammable solids and oxidizing materials, corrosive liquids, compressed gases, and poisons. While the rules themselves, as proposed in this first draft of Part 7 written by the Section of Safety of the Bureau of Motor Carriers, differ but little from those now in force, several important results are anticipated from their promulgation.

Private companies operating their own trucks for transportation of dangerous commodities, as well as common carriers, will benefit by having clearly spelled out in one volume all the rules that apply to the truck transportation of particular commodities. Heretofore the regulations have been split up between two of ICC's Bureaus—the Bureau of Motor Vehicles, and the Bureau of Service. The rules specifying standards for tank trucks and dry freight trucks hauling dangerous cargoes probably will be brought back under the Section of Safety of the Bureau of Motor Carriers.

Rules Enforced

THE NEW ICC rules, when adopted, may receive more strict enforcement. Up to this time, there have been no available printed copies of the rules for explosives and dangerous commodities for general circulation to shippers and motor carriers. In fact, not even ICC's own motor safety inspectors have had copies of the rule book for their own use. When the rules, as finally adopted, are published and made available, ICC inspectors will know the rules themselves, and expect shippers to know and follow them.

Trucking officials agree privately that there have been technical violations of ICC regulations regarding dangerous cargoes, partly because they were spread through several publications, not all of which were available to the shipper or the carrier. As an example of this situation, under present regulations shippers of dangerous liquids in tank trucks of a common carrier now sign a bill of lading or manifest which certifies that the container (ICC says a tank truck is a container) meets the specifications set down in ICC regulations. Actually, the shipper has no knowledge of whether the carrier's tank truck meets these specifications or not. The proposed redraft of these rules would make this the responsibility of the carrier that owns and operates the truck. The legal liability of the private truck owner and operator is spelled out.

Inches Gain Ground

OPERATOR of the Big Inch pipelines, the Texas Eastern Transmission Corp., plagued by threatened legal obstacles and equipment shortages in its effort to put the lines into full production, gained on both these fronts last month. Federal Power Commission gave the company authority to install additional compressor capacity which will boost the lines' delivery of natural gas to 340 million cubic feet per day. Compressor capacity previously authorized would have permitted delivery of 265 million cubic feet per day by November. Actual delivery at the 340 million cubic foot rate is expected by the end of the year.

On the legal side, Pennsylvania announced it would permit the pipeline company to transmit natural gas through the lines in eastern Pennsylvania. Up to the time of this announcement, Pennsylvania had threatened to contest the federal government's right to dispose of the lines for the transmission of natural gas across the state to the New York area. The Big Inch lines are already serving the Pittsburgh area in western Pennsylvania.

These two actions will serve to bring more natural gas to the Pittsburgh area this winter and to speed Texas Eastern's campaign to bring gas through the Inches to the New York and New England areas.

Minor News Glimpses

Wax recovery from sugar cane may be possible according to U. S. Department of Agriculture development at the Southern Regional Lab. The crude wax tends to concentrate in the filter presses which collect sediment formed by clarification of the juices. Potential substitute for other natural waxes is suggested.

Low nicotine tobacco now has a special classification. Those who want to make nicotine will, of course, avoid purchase of this Type 31-V.

Railroad agreements leading to common freight rates have been ruled violations of anti-trust laws by Justice Department people. The Chamber of Commerce of the U. S. and other industrial groups are joining the railroads in opposing that idea. These folks agree that Congress should pass an act specifically exempting the railroads from such prosecution.

Wool legislation passed Congress but was vetoed by the President. That tariff gesture had the support of wool states. And it apparently had support by those who wanted to embarrass United States negotiators planning trade agreements at Geneva in the 18-nation conference there.

Record activity of industry is again proven by the all-time record of electricity output reported by Federal Power Commission. Utility companies, like chemical companies, can't keep up with industrial demand.

Congressional action extending residential rent control had equally great importance for industry. It relaxed practically to the point of removal, most restrictions on construction.

CHEMICAL ENGINEERING
with CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902 AUGUST, 1947 SIDNEY D. KIRKPATRICK, Editor

Management *plus* Science

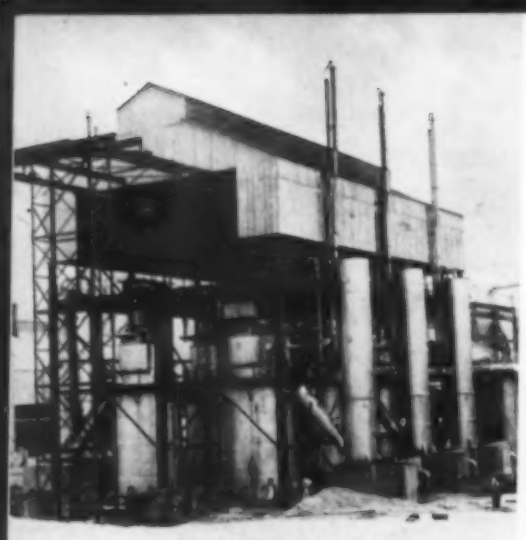
TO AMERICAN industry the new labor law presents a real challenge and a great opportunity. By providing a fairer basis for equitable dealings between management and labor, we have at long last the chance to revive the sort of teamwork that in the past made possible the miracle of America's productivity. That chance will be missed or badly muffed if we enter the game in any spirit of vindictiveness, with any desire to seek revenge for the iniquities that were condoned by former laws and restrictive regulations. And what fair and harmonious relations between management and labor can accomplish for the public good can be immeasurably strengthened by another intangible factor that for lack of better definition we have come to know as Science.

We are not referring solely to the immediate potentialities of scientific management—promising as they are for industrial progress. Great advances have already been made in this direction in spite of limitations and obstacles. Machines and methods have been vastly improved in all except a few industries where labor strife and jurisdictional rivalries have tied the hands of engineers as well as management. Shorter hours, higher wages, better working conditions and lasting benefits in health and safety have been achieved almost universally. But the real problems of productivity cannot be solved unless there is mutuality of interests and ideals. If in the next few months management and labor can attain a greater degree of understanding of common purposes and objectives, we can make more material progress than ever before.

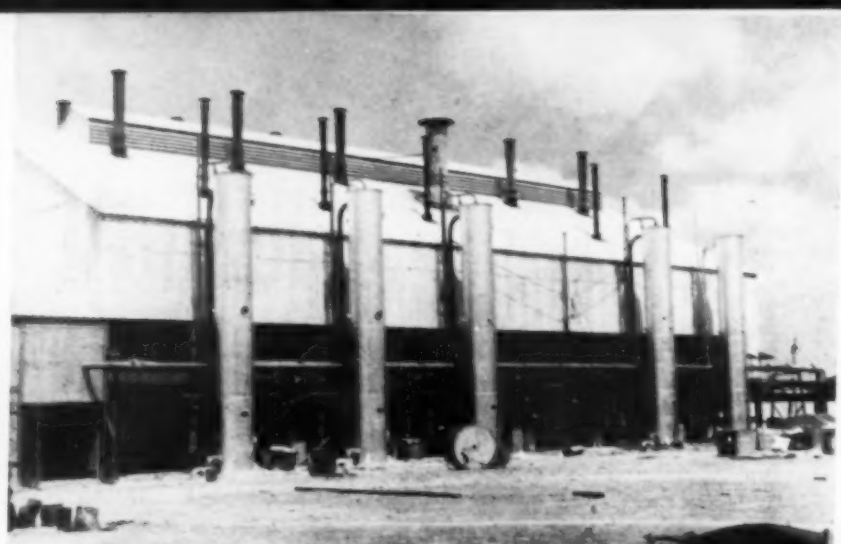
But science has another basic role in industry which holds equal or greater promise for our future. Research, too, can develop most for industry through teamwork with alert, progressive management. Again there is a challenge and opportunity to put this great force to work in the public good. Again there is urgent need for understanding of methods and motives if scientific research is to function efficiently and productively.

Two articles in this issue stress the magnitude and character of the problems faced by chemical management. Fenton Swezey of du Pont Rayon, who wrote our June report on methods of achieving process improvements, has outlined a series of eight steps that management must now pursue with more than usual vigor if our industries are to be adequately prepared for the future. David Hertz of Celanese, who wrote a thought-provoking article last January on the organization of engineering research, is the author of this month's report on management's responsibilities in planning and administering a research program. Those responsibilities far exceed the provision of adequate funds and physical facilities. They call for intelligent understanding of scientific objectives, backed by sound economic and business policies.

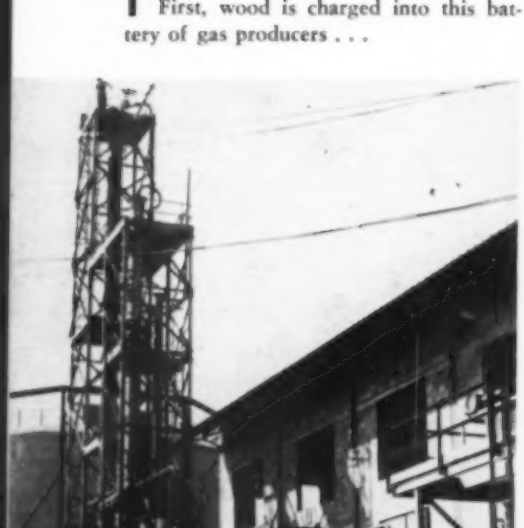
Meanwhile there is equally urgent need for the government to get its own "House of Science" refurbished and in working order now that the National Science Foundation is at last a legislative reality. The many federal research projects that have been held in abeyance or continued on a temporary basis must now be organized and coordinated into a broader program to replenish our waning supply of fundamental scientific information. We must make up for lost time in helping the universities train a new generation of researchers. Management and labor, government and science must all work more closely together in meeting our national needs.



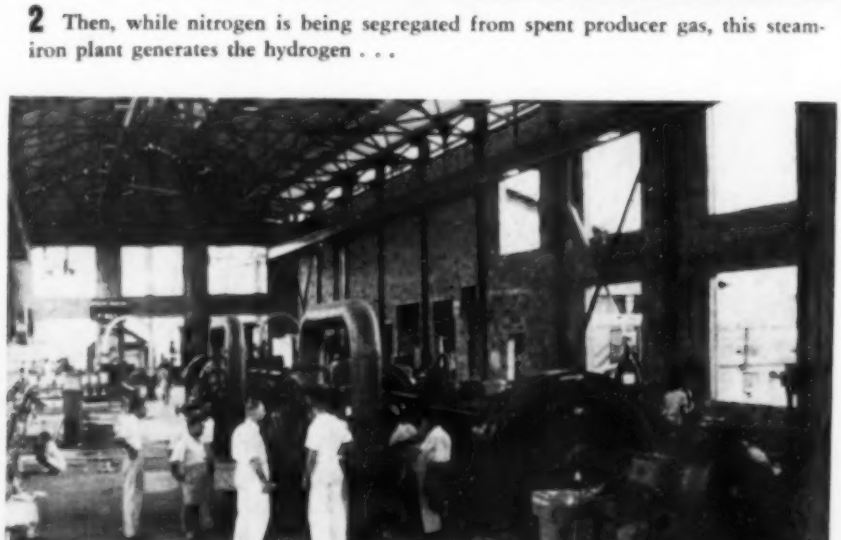
1 First, wood is charged into this battery of gas producers . . .



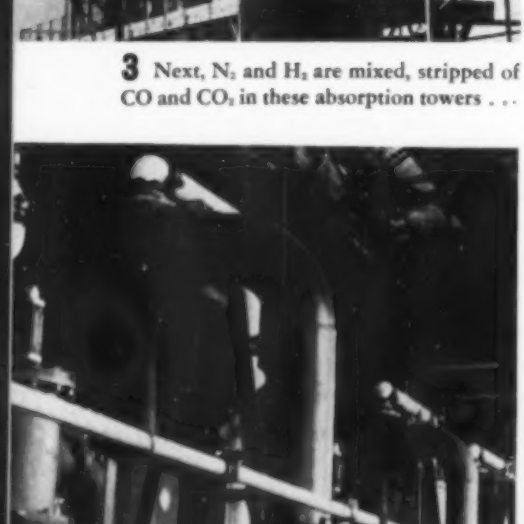
2 Then, while nitrogen is being segregated from spent producer gas, this steam-iron plant generates the hydrogen . . .



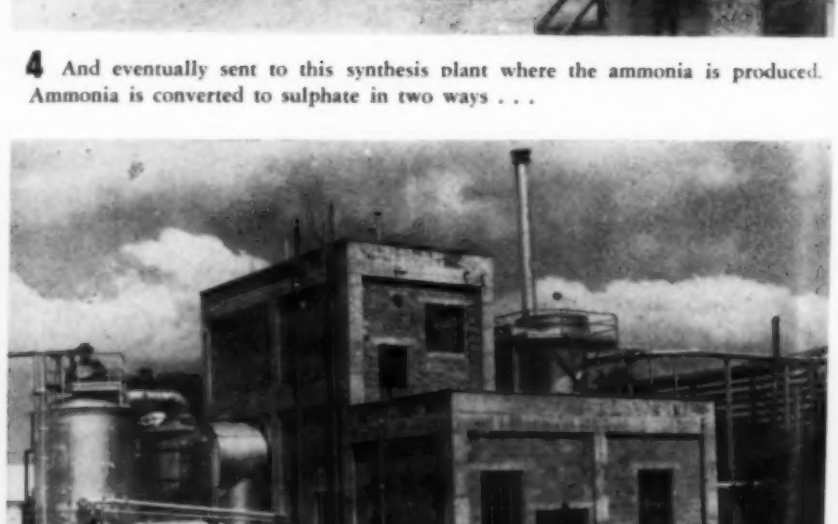
3 Next, N_2 and H_2 are mixed, stripped of CO and CO_2 in these absorption towers . . .



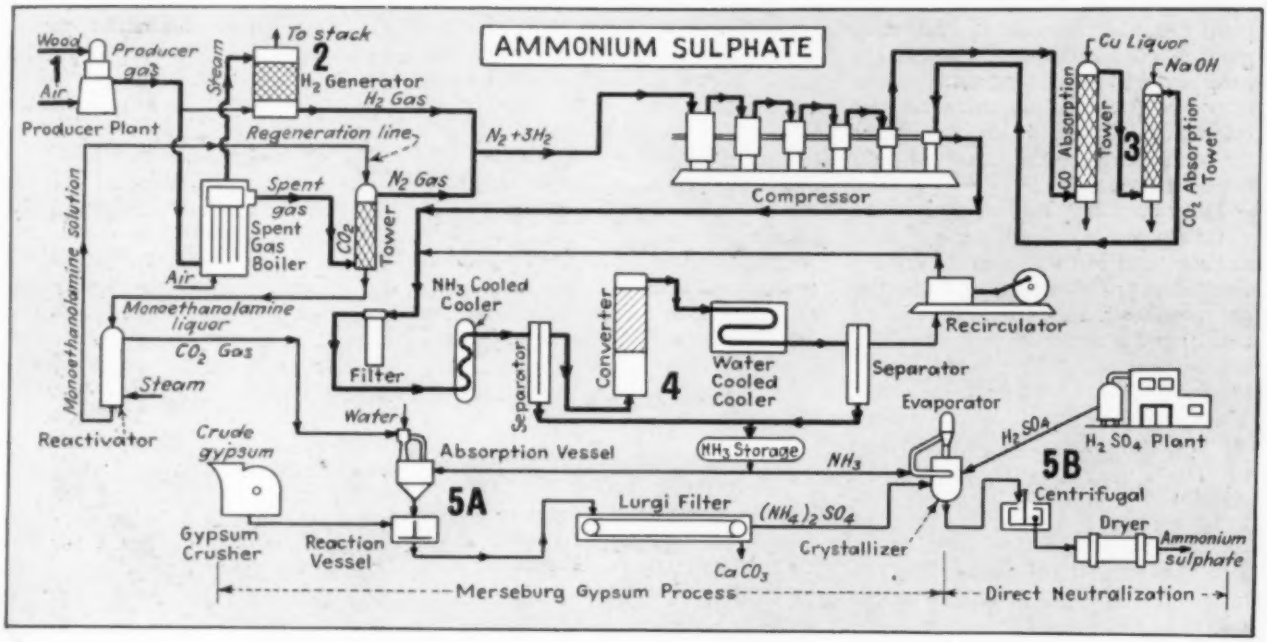
4 And eventually sent to this synthesis plant where the ammonia is produced. Ammonia is converted to sulphate in two ways . . .



5A By carbonation in these absorption vessels, then reaction with gypsum . . .



5B And by direct neutralization with sulphuric acid produced in this standard contact plant. Finally, ammonium sulphate is crystallized, centrifuged and dried.



West Meets East in Unique Engineering Project

J. V. VAN DENBURG, JR.

Bombay Bureau, McGraw Hill World News Service

INDIAN GOVERNMENT IMPORTS AMERICAN ENGINEERING SKILL TO DESIGN AND CONSTRUCT UNUSUAL AMMONIUM SULPHATE PLANT

INDIA has a new $7½ million ammonium sulphate plant. In several of its engineering features, it is the only one of its kind in the world. The plant had to exist on India's natural resources and to accomplish this, the American engineers who built it developed a unique process unused in previous plants. First, they have used wood, which is abundant, instead of coal to get the producer gas with which to make the hydrogen and nitrogen needed for ammonia production. In a second break with convention, the Merseburg gypsum process is, for the first time, combined with direct neutralization to make ammonium sulphate. The salient reasons for this combination were the instability of the gypsum supply, a local need for sulphuric acid, and the desire to obtain plant flexibility.

Recently placed in productive operation, Fertilizers and Chemicals (Travancore), Ltd. or F.A.C.T., as the project is known, has an installed capacity of 150 tons of ammonium sulphate a day. Located near Cochin in the southern state of Travancore, it is the first major chemical fertilizer factory in India. Only other scheduled plant due to surpass it is the Central Government's 350,000-ton-per-year ammonium sulphate factory on which work is just commencing at Shindri, in Bihar Province.

Direct synthesis of ammonia from its elements, one of the outstanding achievements of chemical engineering in the 20th century, was first accomplished commercially in Germany. Subsequently, in its use throughout the world, the original Haber process has undergone several modifications, usually in what may be called mechanical manipulation and frequently to adapt it to some particularly abundant resource. In the United States the so-called American process has been evolved, and in general the design of the Travancore plant follows this process. However, one fundamental difference exists. In all previous plants the necessary hydrogen is made either from coke or natural gas or by electrolysis of water. But here, because of the abundant and extensive hardwood forests of the state, the process has been designed to use wood for generating the gas.

There are three main steps to the process of making ammonium sulphate (1) Gas production and purification; (2) ammonia synthesis; and (3) ammonium sulphate formation.

At the outset, hardwood supplies in lengths up to 8 ft. and diameters up to 24 in. are barged down the river from

the 100 sq. mile tract set aside for the plant's needs. Because of the ideal growing conditions—the tropical climate and 150-in. average rainfall—the reserve will never be exhausted. As they come off the barges the logs are slashed to 16-in. lengths and conveyed into huge warehouses.

From there they are conveyed to the world's largest wood producer-gas plant at the rate of 240 tons a day. Wood is charged continuously into a battery of gas producers to obtain 18 million cu.ft. per day of producer gas containing approximately 22 percent carbon monoxide and 11 percent hydrogen. This section includes five producers, one a spare, and a 200,000 cu.ft. gas holder.

Some of this producer gas is used to reduce the iron oxide contact mass packed in the ten steam-iron generators, two of which are spares. The rest of the producer gas is burned at the rate of 660,000 cu.ft. per day to generate superheated steam. In the next operation, the steam acts on the reduced iron-oxide mass to liberate 3 million cu.ft. per day of hydrogen. The hydrogen plant includes a 100,000 cu.ft. holder. The burned spent gases from the boilers are passed through a Girbitol unit to yield 1,000,000 cu.ft. per day of practically pure nitrogen and 200,000 cu.ft. of carbon dioxide. A 15 percent solution of monoethanolamine is the absorbing liquid used in the carbon dioxide absorption tower.

Purification and Synthesis

A 3:1 mixture of hydrogen and nitrogen is now compressed in five stages to a pressure of 2,200 psi., after which the mixture goes to a high-pressure purification system where the carbon monoxide is removed by a copper formate solution and the carbon dioxide by a sodium hydroxide solution. From here, the purified gas is compressed in the sixth stage of 5,150 psi. and is sent to the synthesis plant. The equipment for the compression and absorption stages consists of two 1,000-hp. six-stage compressors, a carbon monoxide and a carbon dioxide absorption tower.

In the synthesis plant 4,000,000 cu.ft. per day of compressed purified gas joins the stream of recirculating gas, passes through a high-pressure filter, a cooler with ammonia refrigerant, and then a separator. When the gas is chilled, some of the ammonia liquefies and separates out. This is periodically run off to storage.

Next, the gas is sent to the synthesis converter. Here, with a catalyst at high temperature and under high pressure the gas is converted to 16-20 percent ammonia. After water cools the gas from the converter, part of the ammonia is again liquefied, separated and run off to storage. From the second separator, a recirculator picks up the residual gas which goes around the synthesis loop again. In the synthesis loop are two steam-driven circulating compressors, one a spare, for recirculating the gas. Three 162-hp. refrigeration compressors cool the gases in the synthesis loop and the copper formate solution used in the purification process.

Ammonium Sulphate

For the last step in the process, the sulphate plant receives 20 tons of liquid ammonia and 26 tons of carbon dioxide per day. First a 35 percent solution of ammonium carbonate is made by feeding ammonia vapor, carbon dioxide gas, and either water or weak ammonia sulphate liquor into an absorption vessel. From the ensuing exothermic reaction, the heat evolved is used to vaporize the liquid ammonia while the ammonium carbonate liquor formed goes to five wooden reaction vessels to react with gypsum. The gypsum, which is 86 percent pure, is mined in the Trichinopoly section of Madras Presidency, shipped around the tip of India from the port of Cuddalore, and up the Periyar River to the works. It is prepared by crushing, washing, drying, and recrushing to −60 mesh and ultimately will be delivered at the rate of 150 tons per day. The reaction is a double decomposition that forms ammonium sulphate and calcium carbonate.

While 58 tons per day of calcium carbonate are removed by a Lurgi filter and pumped to storage, 75 tons of ammonium sulphate liquor are fed to an evaporator crystallizer. An additional 75 tons of ammonium sulphate are formed there by the direct neutralization of 20 more tons of ammonia vapor and 58 tons of sulphuric acid per day. The ammonium sulphate is evaporated in crystallizing-evaporators and the crystals removed by two continuous centrifuges.

The crystals go to a steam-heated countercurrent dryer and then to bulk storage, while the mother liquor from the centrifuges is returned to the crystallizing-evaporator.

A standard 75-ton-per-day contact sulphuric acid plant using 25 tons of pure Texas sulphur per day supplies the sulphuric acid for the direct neutralization process.

Fitted into the scheme are a steam plant whose three oil-fired boilers have a capacity of 30,000 lb. per hour each and a water filtration plant which supplies both process and sanitary requirements with 15,000,000 gal. per day. The raw materials used daily in the entire process will be: (1) Wood, 240 tons; (2) gypsum, 120 tons; (3) sulphur, 25 tons.

Besides the production of 150 tons per day of ammonium sulphate, there will be a surplus of 17 tons per day of 98 percent sulphuric acid for sale or future process utilization together with several byproducts such as calcium carbonate, cement quality gypsum, carbon dioxide gas, wood tar and tar distillation products.

Power for the plant comes overland from the Pallivasal station. This state hydroelectric plant on the Periyar River sends F.A.C.T. 5,000 kva.

All of the structural work follows American design and methods. In a few minor cases native laterite rock was used but in the major buildings steel and concrete were used.

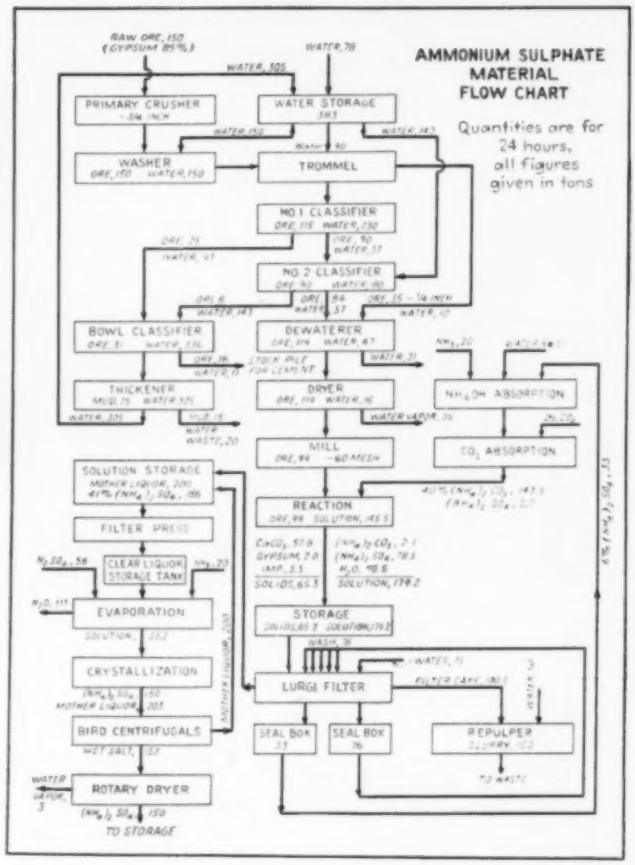
At the peak of construction employment topped 4,300 but when the plant goes into full operation there will remain only about 650 operating personnel. Most of the key Indian personnel during the construction came from Hindustan Aircraft Ltd., an aircraft factory at Bangalore, Mysore State.

Air-Sea Operation

To aid in construction and final operations, a navy and air force were developed as sidelines of the F.A.C.T. project. The navy is made up of a 150-cu.yd.-per-hr. hydraulic dredge, three war surplus LC(S)M landing craft, and five 100-ton heavy-duty barges. The landing craft supply motive power for the barges, which were built at the site for handling materials up river from Cochin. Biggest job these barges handled was the 60-ton converter, the heaviest single item of industrial equipment yet imported into India; the world had to be scoured for a ship with heavy enough tackle to unload it.

The air force was developed because, until recently, airline schedules to Cochin were infrequent. A landing strip adjoining the residential area was graded out and two war-surplus planes were acquired. To increase this transport section a four-place Navion plane has been purchased for executive use.

Construction of ammonium sulphate plants is a part of the Indian government's over-all plan to relieve the critical food shortage that exists there. Late in 1943, members of The Intercontinent Corp. visited Travancore, and there resulted a contract sponsored by the state of Travan-



SUM TOTAL—Here, in aerial view and materials balance sheet, is the over-all achievement of Eastern resources combined with Western technology. Thus, part of the world's problem of famine relief is being solved by helping others to help themselves.

core to establish one of the plants in that state.

Travancore State holds the controlling interest in the company with 51 percent of the shares out of the issued capitalization of roughly $9 million. The adjoining jurisdictions—Cochin State and Madras Presidency—hold 20 percent of the shares between them, and the remaining 29 percent is held by private investors, none of whom has a significant interest. Once the plant is operating to the satisfaction of all concerned it is to be turned over to the managing agents' firm of Seshasayee Bros. Meanwhile, Intercontinent is in full control of all operations.

Who's Who

Intercontinent's contract with F.A.C.T. calls for it to design, purchase, ship, erect and place the plant in operation with a trained staff. Acting as general contractor, Intercontinent has had assistance from Charles Owen Brown, New York consulting engineer, and Singmaster & Breyer of New York. The department of chemical engineering of TVA at Wilson Dam, Ala., through the cooperation of its director, Charles H. Young, and its chief of research, development and engineering, J. H. Walthall, helped in providing for personnel training and technical conference in connection with the ammonia synthesis plant. The contract became effective Jan. 1, 1945. However, first important shipments of equipment began to arrive only in April 1946 due to the war-borne complexities, priorities, shipping space and dollar controls.

The agreement was that as much equipment as possible was to be purchased in Great Britain, due to dollar exchange and other considerations. But in the end Britain supplied only about one third of the imported components and America the rest. Meanwhile, about $480,000 worth of process equipment—tanks, conveyors, vessels and hydraulic operating gear—was built at the site from Indian materials.

Key American personnel in the F.A.C.T. project were: E. P. Pawley, president of Intercontinent; L. C. McCarty Jr., executive vice-president and engineering manager; H. G. Felio, general manager of the plant, and G. L. Giles, assistant general manager.

These four are all long-time Intercontinent men with a long history of construction in the Far East. In addition to them the following men were brought in on contract: H. W. Van Ness, general superintendent of operations; Charles P. Durham, assistant general superintendent; Charles F. Mackey, ammonia superintendent; J. Basil Powell, assistant; Valery S. De Beausset, superintendent of sulphuric acid and ammonium sulphate section; Paul Kandell, assistant; Frank P. Chirico, chief engineer of plant; Carlton W. Gilmore, specialist for erection and high-pressure installation; Frank V. Ranahan, chief of structural fabrication.

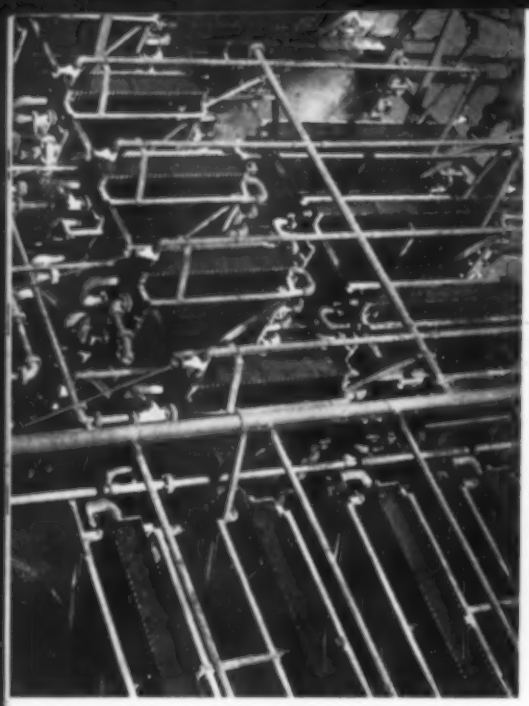
From England came two engineers from Power Gas, loaned for installation of the gas plant—Arthur P. Renshaw and R. Ludbrook.

India has also supplied two top men, both graduates of American chemical engineering schools—Dinshaw Duravalla, chief chemist; and K. A. Verghis, operating foreman of the synthesis plant. Both were retained by Intercontinent in the preliminary stages of planning and worked through the development era in New York.

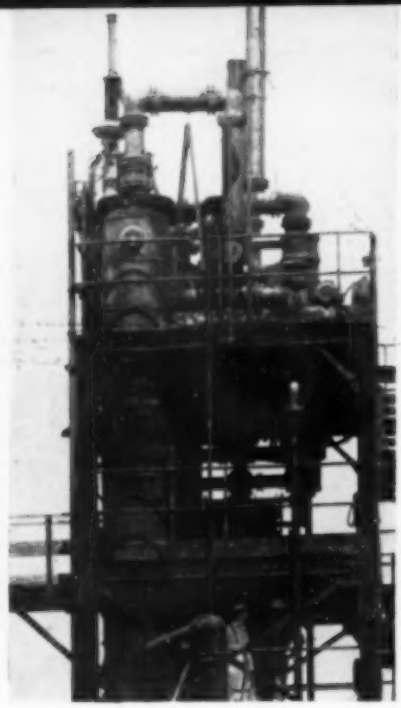
Chief engineer of Intercontinent New York was B. V. Smith. The sulphate plant was designed and engineered by W. Y. Agnew of Singmaster & Breyer.

Meanwhile, there is no doubt of the need for every ton of ammonium sulphate F.A.C.T. produces. According to Intercontinent's studies, rice production throughout India averages only 750 tons per acre. Application of 100 lb. of ammonium sulphate furnishes normal requirements of 20 lb. of nitrogen per acre and increases crop yield by more than 150 percent. In the case of other standard Indian food crops such as ragi, cholum and other grains, approximately the same figures hold good.

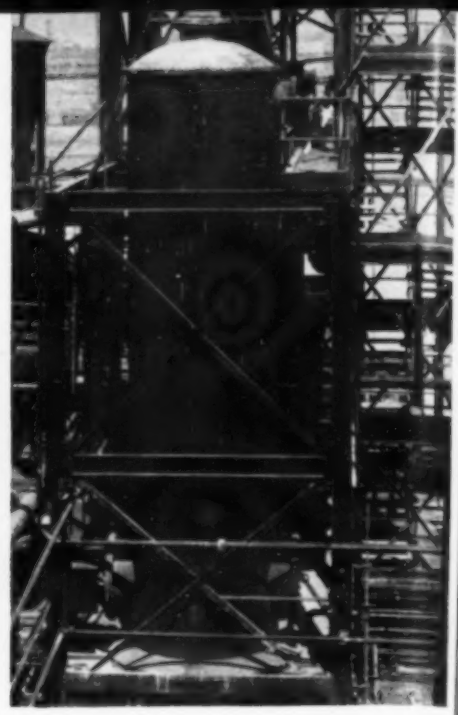
Extending these studies to the over-all Indian picture, in 1946-47 less than 200,000 tons of chemical fertilizers are to be available for some 250 million acres under cultivation. Preliminary studies envision an ultimate potential market for some 2,500,000 tons of chemical fertilizer annually.



KARBATE cascade coolers . . .



HAVEG tails tower . . .



BRICK-LINED cooling tower

Construction Materials in

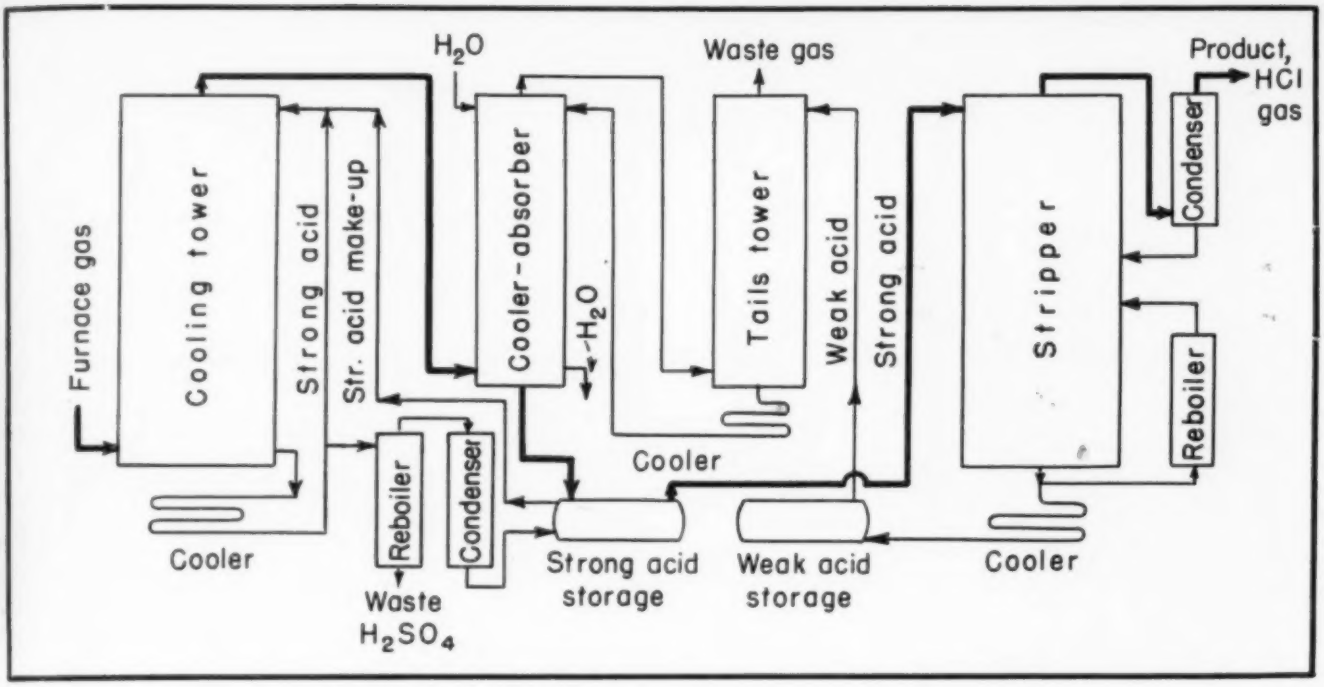
NON-METALLICS MEET DEMAND FOR GOOD HEAT TRANSFER PLUS RESISTANCE TO HYDROCHLORIC, SULPHURIC, AND SULPHUROUS ACIDS

In a number of chemical industries, for example, plastics, alkyl chlorides, and synthetic rubber, hydrogen chloride is required in large quantities in substantially pure form. Synthesis from chlorine and hydrogen gives a product of good quality, but during the war chlorine was scarce and vitally needed in other war operations. Consequently, several of the largest Mannheim hydrogen chloride plants in the United States were constructed to supply the wartime demand. This article tells about the materials of construction used by the Ethyl Corp. to solve corrosion and heat exchange problems in its Baton Rouge plant.

BRIEFLY, the production of concentrated hydrogen chloride by the Mannheim process consists of: (1) reacting salt and sulphuric acid at elevated temperatures to produce sodium sulphate and a gas stream composed principally of hydrogen chloride and air, (2) cooling the gas by countercurrent scrubbing with cooled, recirculated, concentrated hydrochloric acid solution, (3) absorbing the hydrogen chloride from the cooled gas stream in a dilute hydrochloric acid solution, and (4) stripping the hydrogen chloride back out of the resulting concentrated hydrochloric acid to produce a concentrated gas suitable for subsequent use. It is obvious from this brief resume that throughout the recovery process there are encountered gas and liquid streams highly corrosive to the normal materials of construction.

The recovery of hydrogen chloride from a Mannheim plant operation requires the handling, transfer, heating and cooling of various concentrations of hydrochloric acid and for this service Karbate impervious graphite was selected in a number of cases because of its high heat transfer characteristics and immunity to attack by hydrochloric acid or hydrogen chloride gas in any concentration.

A typical plant contains several units, each consisting of a Mannheim type furnace, a cyclone separator for dropping out solids from the gas, a Knight cooling tower for cooling the gas and removing most of the entrained sulphuric acid, a Karbate cooler-absorber for producing concentrated hydrochloric acid from the furnace gases, a Haveg absorption tower for the absorption of weak tail gases off the cooler-absorber into dilute acid, a Karbate impervious graphite stripping tower equipped with two condensers to yield HCl gas containing 0.3 to 0.5 percent water as the only major impurity from the concentrated acid, many banks of Karbate cascade



HCl, H_2SO_4, H_2SO_3—hot and cold, strong and dilute—they all have to be handled

Mannheim HCl Plant

WALLACE F. ARMSTRONG

Superintendent, Ethyl Chloride and Hydrochloric Acid Operations
Ethyl Corporation, Baton Rouge, La.

coolers, and various connecting pipe, pumps and valves of impervious graphite and other materials.

The operation is carried out in two stages: the production of strong gas in the furnace and its absorption to make a concentrated hydrochloric acid, and the stripping of HCl gas from this concentrated acid.

In the first stage salt and sulphuric acid are fed into the Mannheim furnace where, at a very high reaction temperature, sodium sulphate and a gas containing HCl diluted with air are yielded. The salt cake is drawn off and processed for sale, while the gas, under a slight vacuum produced by a blower at the top of the Haveg tails gas tower, is drawn into the absorption system.

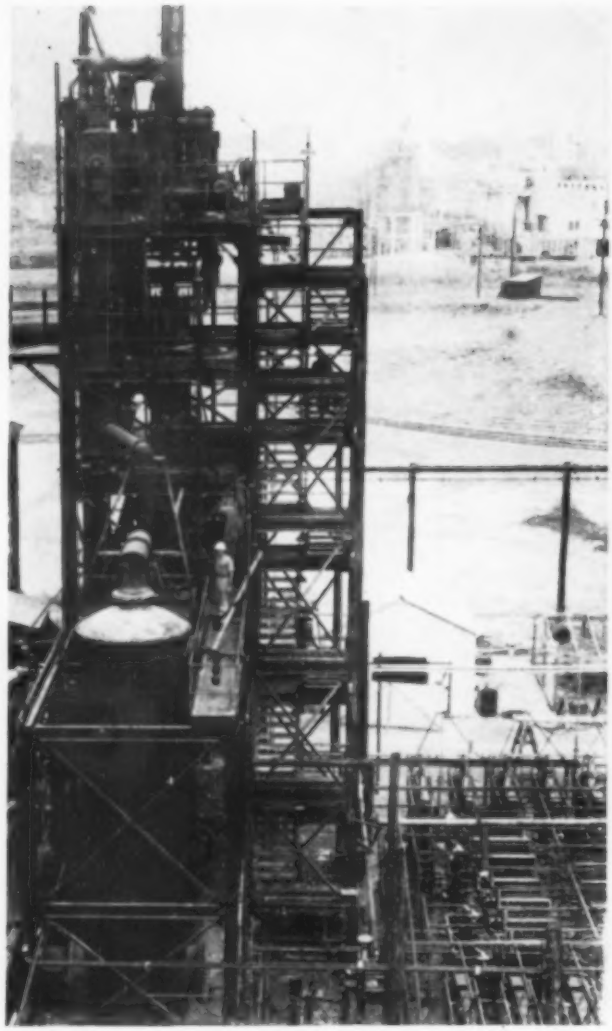
The cooling of the hot, dilute furnace outlet gas is effected in a Knight tower, which consists of a steel shell with two courses of acid-proof brick lining, the courses being separated by a 2-in. layer of glass wool. Plain Raschig rings, supported on a ceramic grid tile, supply contact surface. This tower is resistant to a gas phase composed of air, hydrogen chloride, water and low concentrations of sulphur dioxide, sulphur trioxide, and sulphuric acid. The liquid or cooling medium is a concentrated hydrochloric acid solution, containing a substantial amount of sulphuric acid, present in the tower at temperatures from 86 deg. F. upward. This solution, which is heated by its passage down the tower, is cooled in cascade type coolers, composed of double banks of Karbate pipe and is recirculated by Karbate pumps to the top of the tower.

The absorption of the hydrogen chloride out of the cooled gas is effected principally in an impervious graphite cooler-absorber, with unabsorbed hydrogen chloride being removed from the exit gas in a Haveg tails tower before the gas is discharged to the atmosphere. Dilute hydrochloric acid enters the absorption system at the top of the Haveg tails tower whence it flows to the top of the Karbate cooler-absorber after passing through double banks of impervious graphite cascade coolers. The tails tower is a Haveg shell with porcelain Raschig rings supported on a Haveg grid plate.

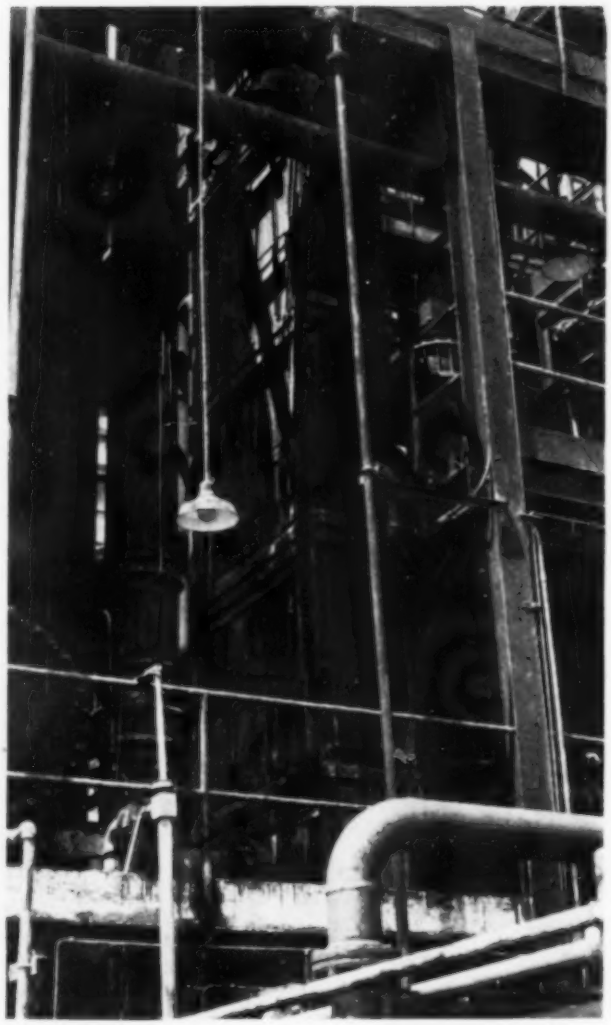
As the cool, dilute hydrochloric acid solution passes down the cooler-absorber it absorbs the hydrogen chloride and that part of the sulphur trioxide and sulphuric acid which have not previously been removed from the gas stream in the Knight tower. The heat of absorption of the hydrogen chloride is removed by the circulation of cooling water through horizontal Karbate tubes which are an integral part of the cooler-absorber, in which the shell, tubes, tube sheets, distributor plate and distributors are all impervious graphite.

This equipment must be able to withstand the action of warm hydrogen chloride gas (about 170 deg. F.), of dilute hydrochloric acid at atmospheric temperatures, and of hot concentrated acid.

The concentrated hydrochloric acid solution from the bottom of the cooler absorber is now ready for the final step of the operation, the recovery of a concentrated hydrogen chloride gas. This recovery is effected by pumping



Orientation of the tails tower, cooling tower and cascade coolers shown close-up on preceding page



Rectangular sectioned cooler-absorber; in cut at left it is out of sight just behind cooling tower

the solution to the top of an impervious graphite stripping tower, packed with 2-in. carbon Raschig rings and connected to the bottom of one of two alternate, vertical impervious graphite reboilers. The stripped solution leaves the reboiler as a constant boiling mixture of hydrochloric acid, sulphuric acid and water which is cooled in Karbate cascade coolers and is then recycled to the cooler-absorber system. The overhead gas from the stripper passes through two identical, vertical impervious graphite condensers, the condensate from which is recycled to the strippers.

The gas from the condensers is now virtually pure hydrogen chloride, containing 0.3-0.5 percent water, ready for use in the manufacture of other chemicals.

In the stripper system, the stripping tower is constructed entirely of impervious graphite and is packed with 2-in. carbon Raschig rings supported by impervious graphite grid plates. Neoprene gaskets are used throughout. The ends of the stripper sections have male and female connections and the entire tower is spring loaded to insure tight joints with an equal differential expansion at all connection joints.

The reboilers are single pass construction with Karbate tubes, tube sheets and head covers and a steel shell and bottom head. Heat transfer rates of approximately 550 Btu/hr./sq.ft./°F. have been obtained at steam pressures of 25-27 p.s.i. gage. The condensers are single pass construction, and, like the reboilers, have a steel shell with Karbate tubes, tube sheets and head covers. The pumps are Karbate units designed for a 100 ft. head.

The stripping tower operates at pressures of 5-8 p.s.i. gage and at top temperatures of about 200 deg. F., while the exit gas from the condensers is at approximately 120 deg. F.

Maintenance problems with impervious graphite equipment are not difficult after a technique for handling the material has been developed. The ease with which the material can be machined (ordinary woodworking tools are sufficient to cut nearly any shape from graphite) and the facility with which it can be cemented together, make repairs and replacement fairly simple. To change a piping layout, for example, the plant maintenance crews seldom bother to change fittings. They cut out the broken section with a hacksaw, cut a replacement piece to proper size, and cement it in place.

When repairs are necessary, successful use has been made of Karbate patches. These are simply blocks or slabs of impervious graphite cemented in place over the area involved, and have been placed both inside and outside of tower sections. Impervious graphite patches have even been used to repair temporarily the holes that have developed in the lining of rubber-lined tanks.

PREMISE: The days of the seller's market are numbered.

PROBLEM: What can management do to get set for a buyer's market?

ANSWER: Improve manufacturing processes. Raise quality of product. Find new uses.

HOW: There's no blueprint for the lazy, no hope for the complacent. Each executive must think and do for himself. But here are eight things to think and do about.

WHAT'S AHEAD?

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E. I. duPont de Nemours & Co., Wilmington, Del.

SPECTACULAR gains in the demand for chemicals and the development of a host of new products have required the installation of many new plants. All major chemical companies are adding capacity. While optimistic forecasts are heard about the continued demand for chemical products, the true picture of future requirements will be determined in a large measure by the business cycle. Even if activity continues at current levels, the additional plant increases now being installed indicate that the period of tight supply may be nearing an end.

This situation suggests that the concentrated attention which management has given to meeting orders must now be turned to consolidating present gains and preparing for the future. The past period of tremendous technical and engineering developments, continued large-scale support of research, unusual merchandising ability and revolutionary process changes indicate the possibility of an unlimited future for chemical industry. It is worth considering what management must do to gain this full potential. Will this great growth continue? Will the tools and methods that have been applied in the past be as successful in the future? What relative parts have management, process, luck, heritage, skill and research played? These questions pose problems for the technical side of management.

Management, as its normal function, continually looks for better methods of manufacture, improved quality and new uses. It will now find it necessary to go beyond some of its normal duties in planning and reaching proper decisions. For example, highly developed "know-how" will be necessary not alone in production, research and engineering but also in merchandising. Some other suggestions for a few "more-than-usual" lines of preparation follow:

1. IMPROVE PROCESSES. An extensive and well planned program directed at improved processes, efficiency and lower costs should be undertaken. These subjects receive continued general attention, but this suggestion refers to a more-than-usual effort. A series of methods for achieving process improvements was outlined by the author in *Chemical Engineering* for June, 1947, pp. 121-128.

2. MODERNIZE OPERATIONS. Present processes and products should receive a technical study from the view points of possible obsolescence and what can be expected from future industrial trends. What is the probable life cycle of the industry? In addition, studies should be made to determine whether operation of any process is now being attempted at levels beyond that of known technology and, conversely, whether in some instances technology might not be considerably advanced beyond present operating conditions.

3. CONSIDER SIZE. The optimum size for operating plants comprises a worthwhile subject for long-range planning. Labor availability, raw material, fuel sources, waste disposal and power supply are well recognized factors governing plant location. Adding to a single location appears attractive because of existing service facilities. In many cases, when more output is needed, capacity is added until some limiting factor is encountered, after which a new location is sought. However, limitations due to one of the above factors should not be the decisive reason for going to a new location. Over-all, long-term efficiency should be. When indicated, means to overcome the limiting factor should be sought. New sources of raw materials and new processes encourage the building of new plants which may well be at a new location. These and other variables should be carefully reviewed.

4. COMMERCIALIZE QUICKLY. The time interval for the commercialization of new processes was greatly shortened in many instances during the war period. The old-time concept that seven years are required for going from the test tube to the tank car was radically changed. The demonstration that large-scale developments can be done more quickly presents a challenge to management.

5. EVALUATE RESEARCH. The greatly increased size of research organizations and accompanying costs warrant a well thought out review of the productivity of research, of the best places to concentrate research effort, and of how to insure that means are available for fully capitalizing on the results obtained. Studies of past researches should be of value in future planning. Some organizations bring out worthwhile developments but are slow to capitalize on them. Others develop a limited number of new processes and products but show marked ability in rapid commercialization.

6. EXPLOIT NEW CHEMICALS. The numerous new chemicals that are now being marketed, together with an anticipated greater volume of better known chemicals in the future at perhaps lower cost, present an opportunity to determine how these can be profitably put to use. Particular attention should be given to the possibilities of developing new classes of synthetic materials. Today's laboratories have in them the synthetics of tomorrow.

7. STUDY RAW MATERIALS. Raw material sources and the materials themselves present attractive possibilities for extensive investigation in order to insure supply, to make use of potential new sources and to be alert to coming technical changes. Current researches dealing with the gasification of coal and the increasing availability of agricultural byproducts illustrate this topic.

8. DEVELOP NEW INDUSTRIES. Potential new industries comprise a fruitful field of management and research attention. The list of infant industries awaiting postwar development compiled by Richard M. Lawrence and published by *Chemical Engineering*, February, 1943, p. 101, is worth review in this connection.

ESTIMATION
Of Field-Erected Tanks

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THIS SYSTEM OF PRE-CONSTRUCTION ESTIMATING PERMITS CORRECTION FOR MATERIAL, LOCATION, TYPE OF CONSTRUCTION AND OTHER FACTORS

PROCESS EQUIPMENT COSTS

DATA in this article were assembled and arranged to provide a rapid means of estimating field-erected tank costs with a reasonable degree of accuracy, obtained from a minimum of design information. The curves and data are corrected to May 1947. Suitable factors should be applied at the time of estimating to compensate for fluctuating costs. Included in the costs are such standard accessories as roof and shell manholes, nozzles and ladders, but no foundations or painting. Freight is also included for a distance of approximately 100 miles. It is always advisable to use fixed quotations for making final estimates as there is often considerable difference in manufacturers' prices. These data represent an average of such quotations and should be useful for preliminary estimates only.

This subject is presented in two ways:

1. A basic method which is applicable over a wide range, but requires two or more steps to obtain the estimated cost.

2. A quick method, derived from the first, which permits reading the estimated cost directly. It has, however, limited application.

Basic Method

Fig. 1 is a curve showing average unit costs for standard API butt-welded, flat-bottom, cone-roof, atmospheric-pressure, steel tanks, delivered and erected in open territory. For variations from these the estimator can use the factors supplied in Tables I and II, and break the cost down into its various components of materials, erection and shop fabrication; then make any necessary adjustments to each component and recombine to arrive at a cost for the required tank.

Fig. 2 is a curve showing average API tank weights for flat-bottom, cone-roof tanks. This curve is based on a tank of approximately square dimensions, namely, the diameter equal to the height, up to about 35 ft., with the diameter taking most of the increase on larger tanks. A maximum height of about 45 ft. was used as it represents the average maximum height of most manufacturers' standard tanks. This curve does not include any allowance for corrosion. The weight of an open tank may be obtained by deducting 20 percent from this curve as the approximate weight of the roof.

Estimating the cost of a standard API steel tank from these curves is quite simple and direct. Using a known capacity, it is only necessary to read the weight from Fig. 2 and then to read the cost per pound from Fig. 1. The estimated cost is then obtained by multiplying the weight by the unit cost. If an allowance for corrosion is required it should be added to the weight determined from Fig. 2 before determining the unit cost. An adjustment should be made on erection cost where the tank's location carries a special rate. This is accomplished by multiplying the erection cost (40 percent of the total) by the ratio of the rates for the specified location and for open territory.

The following steps should be used for estimating an alloy or clad tank.

1. Estimate a steel tank of proper size (Figs. 2 and 1).
2. Correct the cost for location (Table I).
3. Deduct the cost of steel at 3c. per lb.
4. Substitute the new materials cost, correcting the weight where necessary (Table II).
5. Multiply the fabrication and erection cost (total cost of steel tank less steel cost) by the proper factor (Table II).
6. Add the new materials cost and the new fabrication and erection cost.
7. Apply a suitable index of cost trends.

Basic Method Example

Estimate a 100,000-gal. Monel-clad steel, flat-bottom, cone-roof tank to be erected in the New York area. Assume that a manufacturer's standard dimension tank will be satisfactory and that no corrosion allowance will be necessary. The steps are as follows:

The author has worked out two methods for estimating field-erected storage tanks built in a considerable variety of construction materials. The more accurate basic method first estimates the tank as steel, at a particular location, then applies corrections for the cost of the material actually used and the cost of its fabrication and erection. A quicker method employs curves giving cost ranges for tanks of steel and other materials, without the refinements of the basic method.

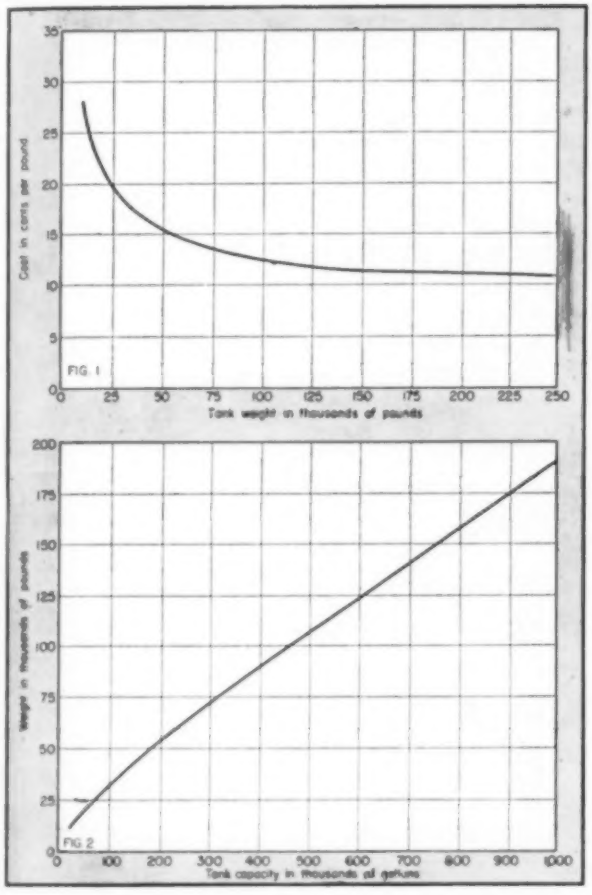

Cost in cents per pound
Tank weight in thousands of pounds
FIG. 1
Weight in thousands of pounds
Tank capacity in thousands of gallons
FIG. 2

Fig. 1—Unit costs for field-erected steel tanks

Fig. 2—Weights of standard API flat-bottom, cone-roof tanks

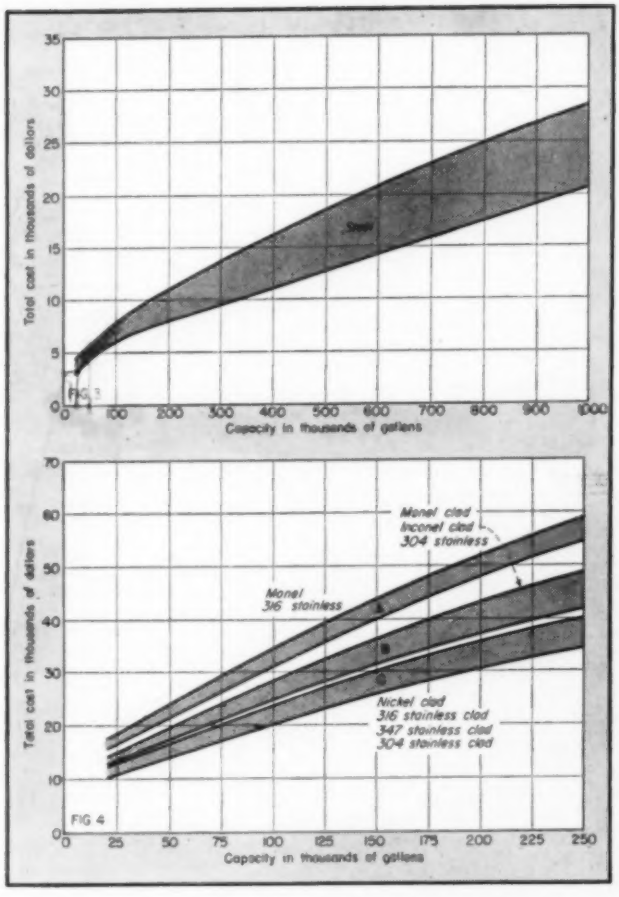


Fig. 3—Cost range curves for standard steel tanks

Fig. 4—Cost range curves for alloy and clad steel tanks

1. From Fig. 2, a 100,000-gal. steel tank weighs 32,500 lb. Unit cost from Fig. 1 = 18c. per lb. Steel tank cost in open territory = 32,500 × 18c. = $5,850.

2. Erection cost in open territory = $5,850 × 40 percent = $2,340. Erection cost in New York area (Table I) = $2,340 × $250/200 = $2,925. Tank cost in New York area = $5,850 − $2,340 + $2,925 = $6,435.

3. Steel cost = 32,500 lb. at 3c. per lb. = $975. Fabrication and erection cost of the steel tank = $6,435 − $975 = $5,460.

4. Monel-clad steel (20 percent clad) weighs 1.02 times steel (Table II). Weight of Monel-clad tank = 32,500 × 1.02 = 33,150 lb. Material cost for Monel-clad tank at 47c per lb. = 33,150 × 0.47 = $15,580.

5. Fabrication and erection cost for Monel-clad tank (Table II) at 225 percent of fabrication and erection cost for steel = $5,460 × 225 percent = $12,300.

6. Estimated cost of Monel-clad tank in New York area = $12,300 + $15,580 = $27,880.

Table I—Factors for Estimating Other Than Standard API Steel Tanks

Item	Factor
Erection cost	40 percent of Fig. 1
Full penetration welding	Add 5 percent to Fig. 1
Non-standard dimensions*	Add 5 percent to Fig. 1
Location	Erection Rates, Dollars per Hr.
Open territory	2.00
New York area	2.50
Chicago area	2.12
Southeast U.S.A.	1.875

*Most manufacturers have their own standard sizes.

Quick Method

Figs. 3 and 4 are curves which have been prepared from the above data to provide a quick estimate at a glance for standard dimension tanks. These do not permit the flexibility nor the accuracy of the basic data which can also be applied to non-standard tanks. Fig. 3 is a curve showing the cost of steel tanks over a range of capacities. All maximum costs were combined to form the high side of the curve and all minimum costs were combined to form the low side. The spread in this curve is caused by the following: (1) Erection rates at dif-

(Continued on page 122)

Table II—Factors for Estimating Materials Other Than Steel

(Prices include base price plus 20 percent for extras)

Material	Relative Weight	Cost, Cents per Lb.	Fabric. & Erec. Costs, Percent of Steel	Material	Relative Weight	Cost, Cents per Lb.	Fabric. & Erec. Costs, Percent of Steel
Steel	1.00	3	(Calculated from Fig. 1)	347 stainless clad steel	1.00	32	220–230
Nickel clad steel	1.02	34	220–230	304 stainless steel	1.01	38	250
Inconel clad steel	1.015	48	220–230	316 stainless steel	1.01	58	250
Monel clad steel	1.02	47	220–230	Monel	1.11	49	265–275
304 stainless clad steel	1.00	29	220–230	Inconel	1.08	74	265–275
316 stainless clad steel	1.00	34	220–230	Nickel	1.12	62	265–275

PINE GUM

Processing Labor and Fuel Costs

H. P. POOLE and E. L. PATTON

Naval Stores Station, Olustee, Fla.*

FUEL COSTS AND LABOR REQUIRED IN PROCESSING PINE GUM ARE STUDIED AT A MODERN PINE GUM PROCESSING PLANT IN FLORIDA

Operation of a modern gum processing plant has been studied to determine the fuel costs for the total steam required to process a standard barrel of crude pine gum and to collect data on the labor required to operate the plant. Results indicate that approximately 0.9 man-hour of labor was required to process each barrel of the crude pine gum. The results of this study, made at the Naval Stores Station in Olustee, Florida, are presented here.

In the gum naval stores industry most of the modern central plants use steam for cleaning the crude pine gum, or oleoresin, and for distilling it into turpentine and rosin. Many of these plants employ the method (U. S. Patent No. 2,254,785) based on diluting, filtering, washing, and distilling gum which was developed by the Naval Stores Station of the U. S. Department of Agriculture, Olustee, Florida, and is commonly known as the "Station" or "Olustee" process. A plant using this process needs steam for removing the crude gum from the dip barrels when emptied into the dump vats, for melting and filtering the gum, for distilling the gum, and at several other points in the plant. (A Gum Cleaning Process, by E. L. Patton, to be published). Because steam is so essential in the production of turpentine and rosin, it was considered important to determine the boiler fuel costs of the total steam required for the complete processing of crude pine gum. Both oil-fired and coal-fired boilers are commonly used in the industry, and since both types were available, tests were run with each type separately, as well as a test with both types together. This study also afforded an opportunity to obtain data on the man-hours of labor required in processing pine gum.

Description of Tests

These tests were run at one plant only. It must not be inferred that the results obtained and reported herein are considered typical or "average" for other plants in the naval stores industry.

The data reported were collected during the summer of 1946 at one of the modern central plants in southern Georgia which was processing from 150 to 200 bbl. of pine gum per day. Details of each test run are shown in Table I. All results are calculated on the basis of one standard barrel of crude pine gum, weighing 435 lb. net.

The coal-fired boiler was a single-pass, hand-fired, 200-hp., fire-tube type. The oil-fired boiler was an automatic, four-pass, 200-hp., fire-tube type. The tests were conducted as nearly alike as possible. Each test was run for from three to six days to minimize the effect of daily variations. To obtain an operational balance it was necessary to check the amount of gum received, melted, and distilled during each test. It was also necessary to check the amount of gum in storage in the dump vats, blowcases, melters, and wash tanks at the beginning and end of each test.

Steam pressure is one factor which limits the capacity of a gum cleaning plant, because with a high and steady steam pressure the capacity is greater and the operation is smoother. In the tests described, a recording steam pressure gage was installed in the plant steam line. From the daily charts the over-all average steam pressure was calculated, as well as the average maximum and minimum pressures.

For the tests with the coal-fired boiler, the coal used was "run of the mine" bituminous. It was purchased on an air dry basis and cost $7.06 per ton delivered to the plant. As a matter of information, the moisture content of several samples of the coal was determined by heating to constant weight at 105 deg. C. This figure ranged from 3.4 percent to 6.0 percent for five samples, with an average of 4.6 percent. The coal used was weighed as it came from the stock pile. It was necessary to slow down the coal-fired boiler once or twice a day to remove clinkers. This operation required about 15 to 20 minutes and during this period the steam pressure dropped from an average of about 135 psi. to as low as 50 psi. ga. Whenever the steam pressure dropped below 70 psi. it was necessary to shut down the still. Such intermittent operation was both inefficient and costly.

For the tests with the oil-fired boiler, the fuel oil used was Bunker C, which is equivalent to fuel oil No. 6. It cost 4.8 cents per gal. delivered to the plant. It had a specific gravity of 0.9725 at 60 deg. F., equivalent to 14.0 deg., API, or 8.1 lb. per gal. The volume and temperature of the fuel oil in the storage tank were measured at the start and end of the test. The volume-temperature correction was made to 60 deg. F., which is the basis

* This Station is a part of the Naval Stores Research Division, Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture.

Table I—Boiler Fuel Cost for Processing Pine Gum

	Coal Boiler	Oil Boiler	Comb'n. Both Boilers
Duration of test, days (24 hr.)	4	3	6
Bbl. (435 lb.) crude gum rec'd	882	499	1,212
Bbl. crude gum rec'd per day, av.	221	166	202
Bbl. gum distilled (crude gum basis)	878	476	1,200
Bbl. gum distilled per day, av.	219	159	200
Av. min. steam pressure, psi. ga.	61	75	121
Av. max. steam pressure, psi. ga.	135	140	138
Overall av. steam pressure, psi. ga.	104	113	129
Lb. coal (air-dry) used	56,100	...	36,000
Lb. coal per bbl. crude gum	64	...	30.2
Cost of coal per ton, dollars	7.06	...	7.06
Cost of coal per bbl. crude gum, cents	23	...	10.6
Gal. oil (60 deg. F.) used	.....	1,554	2,494
Gal. oil per bbl. crude gum	.....	3.11	2.06
Cost of oil per gal., cents	.....	4.8	4.8
Cost of oil per bbl. crude gum, cents	.....	15	9.9
Total fuel cost per bbl. crude gum, cents	23	15	20.5

Table II—Labor Required for Processing Pine Gum

	Coal Boiler	Oil Boiler	Comb'n. Both Boilers
Duration of test, days (24 hr.)	4	3	6
Bbl. (435 lb.) crude gum processed	882	499	1,212
Bbl. crude gum processed per day, av.	221	166	202
Gum grader (1), regular time	33 man-hr.	22 man-hr.	48 man-hr.
overtime	7	6	15
Deck hands (3), regular time	100	75	144
overtime	15	16	32
Melter operator (1), regular time	34	25	50
overtime	9	6	19
Melter helper (1), regular time	34	25	48
overtime	8	5	10
Stiller (1), regular time	34	25	50
overtime	20	7	18
Rosin drummer (1), regular time	34	25	48
overtime	20	5	10
Rosin yard labor (3), regular time	102	75	144
overtime	15	15	30
Fireman (1), regular time	34	25	50
overtime	20	4	17
Fireman's helper (1), regular time	34	..	...
overtime	20	..	...
Mechanic (1), regular time	33	26	46
Mechanic's helper (1), regular time	33	26	46
Labor, general (1), regular time	25	20	46
Watchman (2), regular time	46	48	96
Office help (1), regular time	34	28	57
Manager (1), regular time	34	28	52
Total regular time, actual man-hours	644	479	925
Total overtime, actual man-hours	134	64	151
Total man-hours, actual	778	543	1,076
Total man-hours, paid for (Includes overtime at 1.5 regular time)	845	575	1,152
Labor per barrel of pine gum processed:			
Total man-hours per bbl., actual	0.88	1.09	0.89
Total man-hours per bbl., paid for*	0.96	1.15	0.95

*Includes overtime at 1.5 regular time)

Note; The number in ( ) refers to the number of employees.

of purchase of fuel oils. This calculation was made as outlined in Perry's "Chemical Engineers' Handbook," 1941, p. 2346, and is based on the National Bureau of Standards Circ. No. 154. It was necessary to remove the carbon from the fire box of the oil-fired boiler about every three hours, but this operation required only three or four minutes and the steam pressure seldom dropped below 110 psi. The automatic controls on the oil-fired boiler worked satisfactorily and permitted the elimination of one man (fireman's helper) from the payroll.

Time required each morning to build up the steam pressure was about one hour with the coal-fired boiler and about 1.5 hours with the oil-fired boiler.

Labor Requirements

Total labor required for the complete processing of pine gum depends on several considerations, including the total number of employees, the capacity of the plant, the quantity of gum received, and the rate at which it is received. This last factor affects the amount of overtime required—most plants are dependent on outside sources for their supply of pine gum, and although crude gum is brought into the plant daily, the quantity received per day varies considerably. When more than the normal daily amount of gum is received it is often necessary for some of the plant to be run overtime so as to be ready to receive gum the next day. On the other hand, when a small amount of gum is received the plant still has the same number of employees present, with the result that the amount of gum processed per man-hour is relatively smaller. It is believed that these tests were made over a long enough period to give a fairly reliable estimate of the total labor required for processing crude gum in a plant using the Olustee process.

The number of man-hours required for each operation was recorded as shown in Table II. Both regular time and overtime (over eight hours per day or over 40 hours per week) are shown. Because the pay differential between jobs varies considerably, no attempt was made to compute labor costs; but with the man-hours shown for each job this calculation will be a simple matter for any given wage scale. The man-hour study included the entire personnel of the plant.

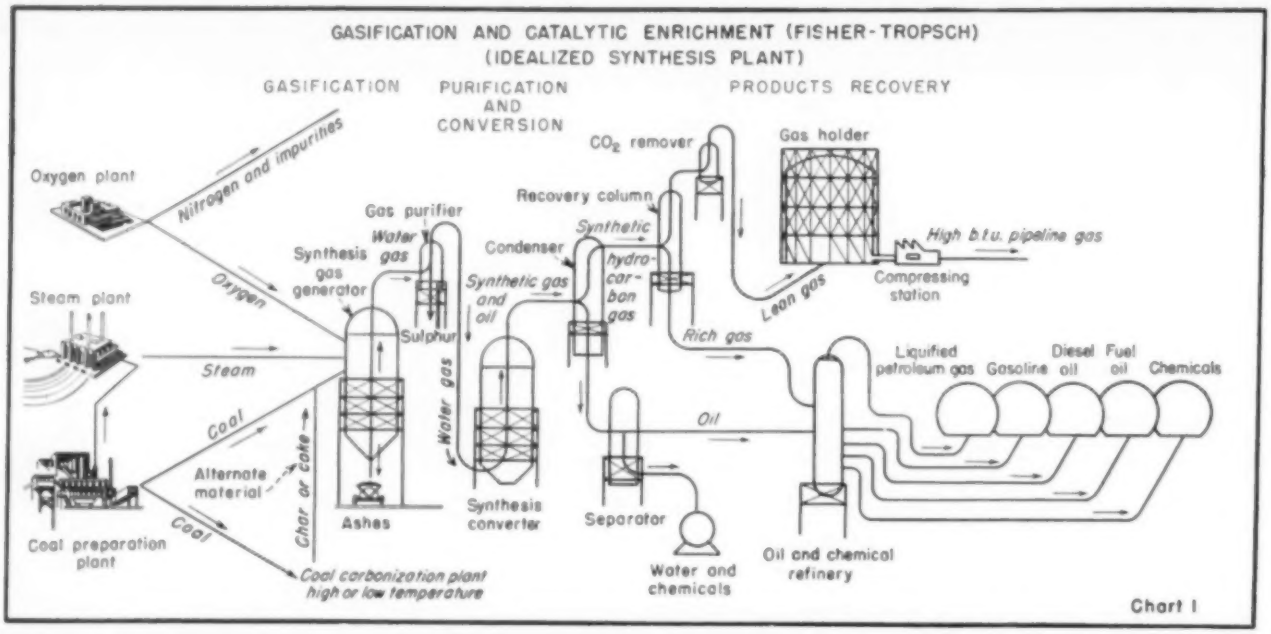
For crude gum processed, data in Table I show that, with fuel oil at 4.8 cents per gal., the oil-fired boiler consumed 3.1 gal. of fuel oil at a cost of 15 cents per bbl. of gum processed. With coal at $7.06 per ton, the coal-fired boiler consumed 64 lb. of coal at a cost of 23 cents per bbl. of gum processed. When the two boilers were run together, the fuel consumption amounted to 2 gal. of fuel oil and 30 lb. of coal at a cost of 20.5 cents per bbl. of gum processed.

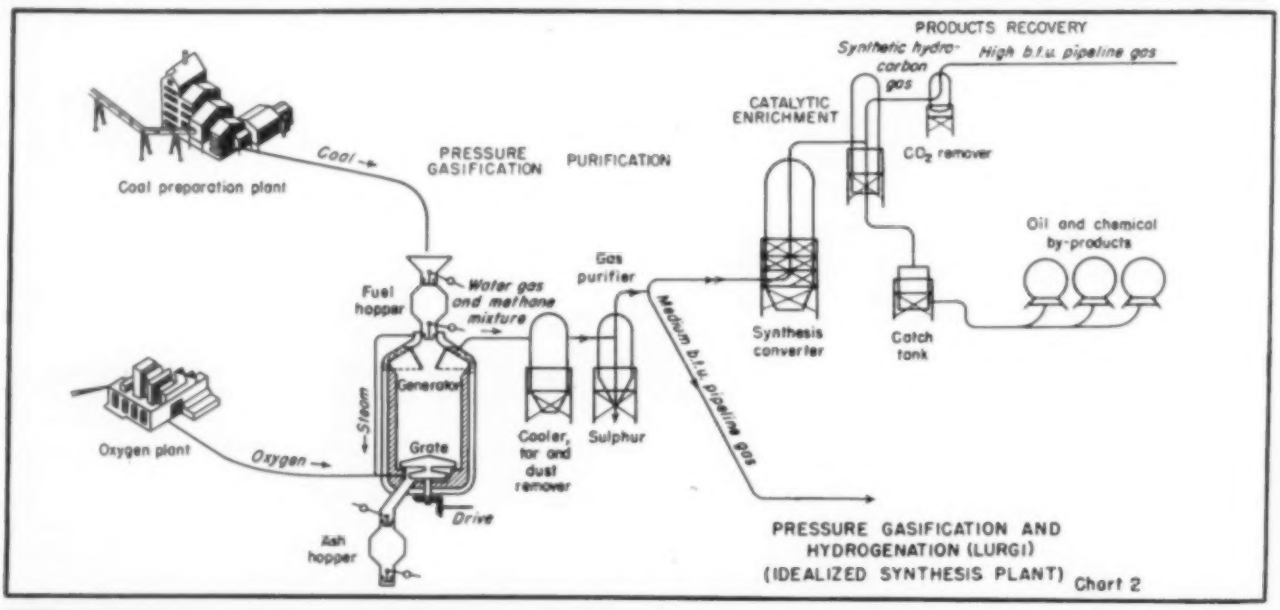
Conclusions

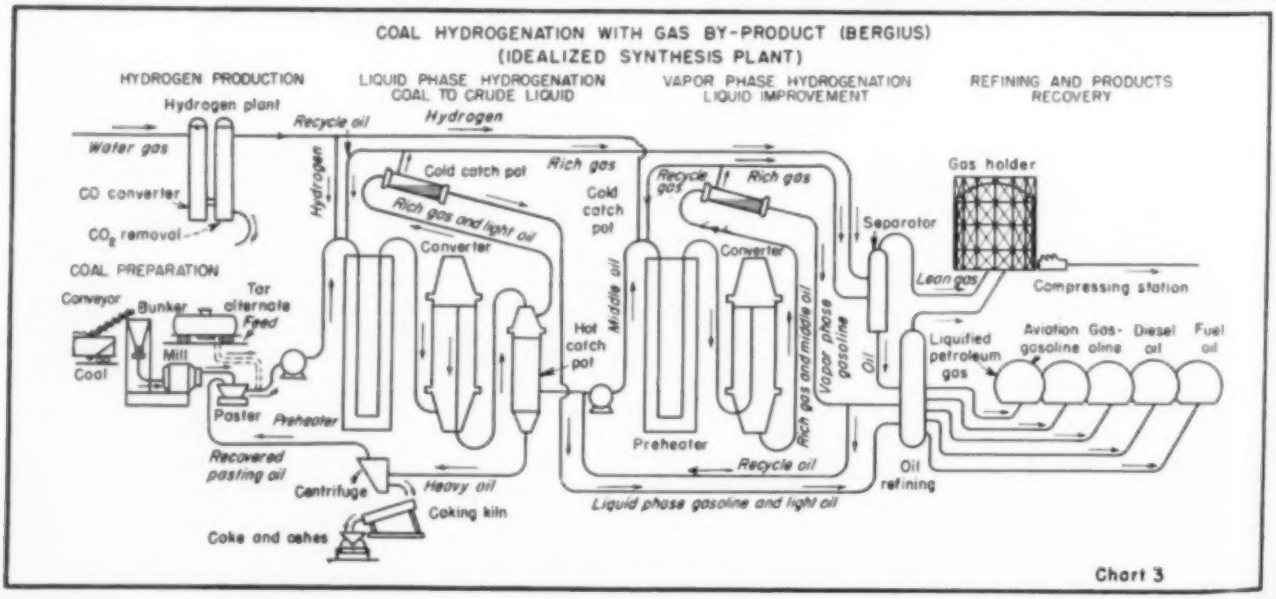
It is to be noted that neither boiler alone supplies sufficient steam for the maximum demand load of the plant. Both boilers together amply supplied this demand but in doing so their total fuel consumption was about 13.5 percent greater than the fuel used by either boiler operated separately. Therefore, if either boiler were increased in size sufficiently to supply the maximum load of the plant, it may be assumed that it would consume some 13-15 percent more fuel. This means that the fuel costs per bbl. of gum would be increased to about 17 cents for oil and 26 cents for coal.

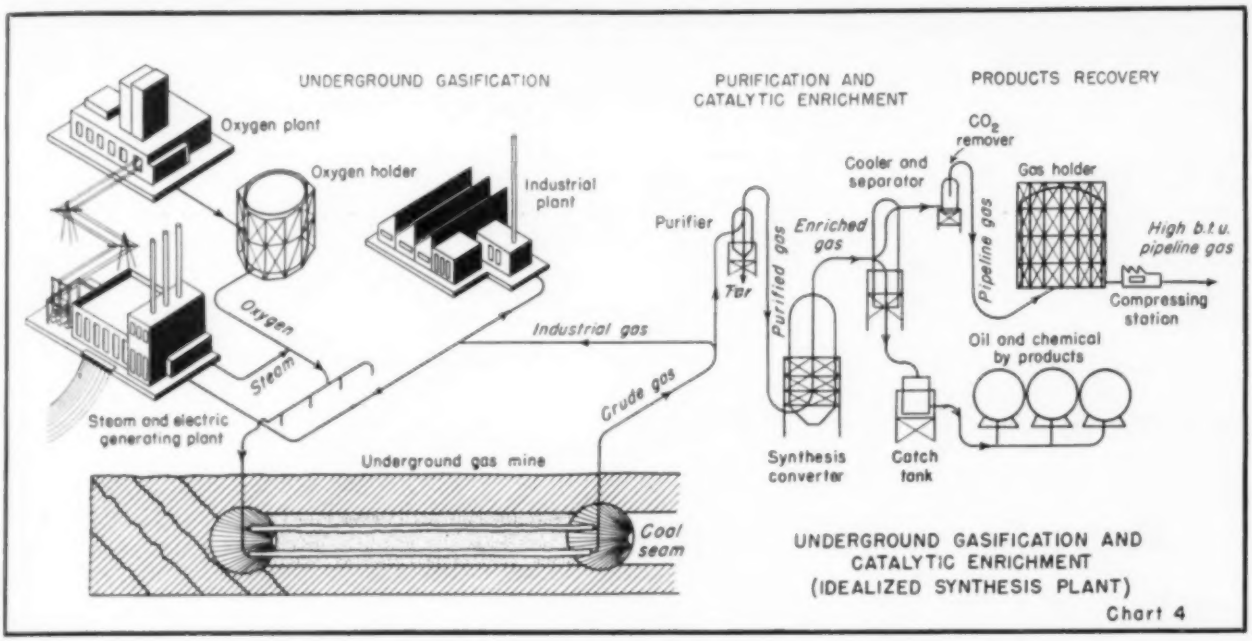
This study indicated that for a plant of this type processing 150 to 200 bbl. of crude gum in approximately ten hours, a 200-hp. boiler, either oil-fired or coal-fired, is not large enough. Much smoother and more efficient operation could be obtained with a 250-hp. boiler.

The total labor required (Table II) appears to be approximately 0.9 man-hour per bbl. of crude gum processed. As already noted, when operating the oil-fired boiler the fireman's helper was eliminated, and it would, therefore, be expected that the total labor would be less with the oil-fired than with the coal-fired boiler. The data in Table II do not indicate this saving, but it should be noted that during the test with the oil-fired boiler the plant processed an average of only 166 bbl. of gum per day, compared with 221 bbl. per day with the coal-fired boiler. If the gum processed during the test with the oil-fired boiler had been over 200 bbl. per day, the total labor per bbl. would undoubtedly have been as low or lower than that shown with the coal-fired boiler.


GASIFICATION AND CATALYTIC ENRICHMENT (FISHER-TROPSCH)
(IDEALIZED SYNTHESIS PLANT)
GASIFICATION
PURIFICATION AND CONVERSION
PRODUCTS RECOVERY
Oxygen plant
Nitrogen and impurities
Oxygen
Steam plant
Steam
Coal
Alternate material
Coal
Coal preparation plant
Char or coke
Coal carbonization plant high or low temperature
Synthesis gas generator
Ashes
Gas purifier
Water
Sulphur
Water gas
Condenser
Synthetic gas and oil
Synthesis converter
Recovery column
Synthetic hydro-car-bon gas
Separator
Water and chemicals
CO_2 remover
Rich gas
Oil
Gas holder
Lean gas
High b.t.u. pipeline gas
Compressing station
Oil and chemical refinery
Liquified petroleum gas
Gasoline
Diesel oil
Fuel oil
Chemicals
Chart 1


PRODUCTS RECOVERY
Synthetic hydro-carbon gas
High b.t.u. pipeline gas
CATALYTIC ENRICHMENT
CO_2 remover
Oil and chemical by-products
Coal preparation plant
Coal
PRESSURE GASIFICATION
PURIFICATION
Fuel hopper
Water gas and methane mixture
Gas purifier
Medium b.t.u. pipeline gas
Synthesis converter
Catch tank
Generator
Steam
Oxygen plant
Oxygen
Grate
Drive
Ash hopper
Cooler, tar and dust remover
Sulphur
PRESSURE GASIFICATION AND HYDROGENATION (LURGI)
(IDEALIZED SYNTHESIS PLANT)
Chart 2


COAL HYDROGENATION WITH GAS BY-PRODUCT (BERGIUS)
(IDEALIZED SYNTHESIS PLANT)
HYDROGEN PRODUCTION
LIQUID PHASE HYDROGENATION COAL TO CRUDE LIQUID
VAPOR PHASE HYDROGENATION LIQUID IMPROVEMENT
REFINING AND PRODUCTS RECOVERY
Hydrogen plant
Water gas
CO converter
CO_2 removal
Recycle oil
Hydrogen
Cold catch pot
Rich gas
Rich gas and light oil
Converter
Cold catch pot
Recycle gas
Rich gas
Converter
Separator
Gas holder
Lean gas
Compressing station
COAL PREPARATION
Conveyor
Bunker
Tar alternate Feed
Coal
Mill
Paster
Preheater
Recovered pasting oil
Centrifuge
Heavy oil
Coking kiln
Coke and ashes
Hot catch pot
Middle oil
Preheater
Recycle oil
Rich gas and middle oil
Vapor phase gasoline
Oil
Oil refining
Liquified petroleum gas
Aviation gasoline
Gas-oline
Diesel oil
Fuel oil
Liquid phase gasoline and light oil
Chart 3



Four New Ways to Manufacture High B.t.u. Gas From Coal

FUTURE SUPPLIES OF NATURAL GAS CAN BE SUPPLEMENTED BY COMMERCIAL APPLICATION OF NEW GAS MANUFACTURING PROCESSES

CURRENT abundance of natural-gas reserves is probably temporary. Whether it takes ten or twenty years for this situation to change, the time may be short thereafter in which to adjust the then expanded markets to an alternate fuel, much less to initiate a wholly new industry to take up the development of low-cost manufactured-gas production. Meanwhile, as to one important factor there can be no doubt. Over a period of years, but more particularly since the end of the recent war, there is unmistakable evidence of an almost unlimited demand for a cheap gas fuel.

In view of this country's natural-gas resources as compared with coal, it seems certain that some time in the future there will be a need for a replacement gas. How rapidly this will materialize, however, is contingent upon future natural-gas discoveries, future demands for and future consumption of gas fuels, and the relative prices of natural and manufactured gas. Meanwhile, the cost of manufacturing gas from coal is far above the price of natural gas.

There are, however, good prospects for reducing the cost of manufacturing gas through technologic development of new processes. If, through these, production costs are reduced, it may be possible to produce high B.t.u. gas in the not-too-distant future in areas of relatively high natural-gas prices, where conditions are especially favorable to the initiation of commercial operations. Initiating such operations would assure continuously ample gas supplies for the enlarged utility service rendered by natural gas, and at the same time prevent disruptive future increases in natural-gas utility rates when natural-gas discoveries decline.

Further improvements would make this supply progressively competitive with natural gas for industrial purposes. Should natural-gas supplies thereafter shrink and its price increase substantially, the availability of such a replacement supply will facilitate a gradual shift in the source of gas, with minimum interference in service or rates or in the pipe-line networks and distributing systems developed to handle gas fuel. At the same time, this country's natural-gas and coal resources would be geared together as a common reserve, to provide an ample supply of low-cost gas fuel to meet all foreseeable needs.

Future Processes

The development of a synthetic fuel gas replacement for natural gas is a project in which many industries may share to their mutual benefit. To the natural-gas industry it means assurance of a future low-cost gas supply, to the petroleum industry a new source of liquid fuels, and to the coal industries new and broader markets for manufactured gas, enlarged coal consumption, a higher value for lower-grade coals and a better balance generally in the coal utilization economy. The exact route or ultimate destination of these developments cannot now be predicted, but several processes indicate commercial possibilities.

Describing how a synthesis plant

Taken from "Prospects for Production of a Substitute for Natural Gas", Federal Power Commission Natural Gas Investigation (Docket No. G. 580).

Refer to "Recent Developments in Fuel Technology", Chem. Eng. April 1947 pp. 127-132.

might be designed to produce a replacement gas must be in very tentative terms. Nevertheless, idealized diagrammatic plants, representing illustrative combinations of different processes, offer a means of visualizing the range of possibilities as to raw materials, their treatment, and the products which may be derived. For this purpose, four charts show examples of plant combinations whose individual parts either have already been commercially used, or in which variations are in advanced stages of pilot-plant testing. These might be used, either as shown or with modifications, to provide not only an abundance of high B.t.u. gas but also liquid fuel, chemicals, and smokeless solid fuel.

Fischer-Tropsch

Chart I shows what is rather widely regarded as the most promising plant combination namely, the Fischer-Tropsch method starting with coal, and illustrates one of several possible plants following that general route. The natural resources: solid fuel, air and water—are used as raw materials to produce water gas, which is then purified and converted through a Fischer-Tropsch converter into a mixture of synthetic hydro-carbons and chemicals. These may then be separated and refined into a complete range of commercial products duplicating those now derived from natural gas and petroleum.

The initial gasification step of the process illustrated in Chart 1 shows alternature methods with coal, coke or char used as alternate feeds, depending upon the gasification process employed. In the United States, water gas has been produced until now exclusively in fixed-bed cyclic generators, using high-temperature coke. However, foreign technologists, searching for a cheaper means of producing large volumes of water gas, have developed several new gasification methods using char and low-grade coal.

Chart 2, entitled "Pressure Gasification and Hydrogenation," starting with the Lurgi pressure gasification process, shows one example of a plant designed to operate at about 300 lb. per sq. in. to produce a gas with about three times the heating value of water gas. In the plant illustrated, prepared coal (or possibly char or lignite) is fed through a pressure-tight feed chamber into a pressure gasification retort and there gasified with steam and oxygen. The inner vessel, lined with refractory brick, is water-jacketed to protect the thick-wall pressure shell from the high temperature. Steam produced in the water jacket provides one of the materials for the gasification process. Ashes are removed at the bottom and the gas is drawn off near the top. The gas product, a mixture of water gas and methane, is then cleaned and ready for use. If a still higher B.t.u. gas is desired, this mixture may be further enriched by transforming some of the water gas into hydro-carbons, to give a high B.t.u. gas already under pipe-line pressure.

Bergius Process

Still another approach is shown in Chart 3, entitled "Coal Hydrogenation With Gas By-Product." In this case, ultra-high B.t.u. gas is a by-product of the production of synthetic liquid fuel by the hydrogenation of coal, through what is commonly called the Bergius process. The hydrocarbon gas is a by-product. Here coal may be made into a paste and, under extremely high pressure, chemically transformed with hydrogen gas into a wide range of gaseous and liquid hydrocarbon fuels. The conversion is performed in two steps at pressures of 3,000 to 10,000 lb. per sq. in. and about 800 deg. F.

As shown in the plant illustrated, tar can be converted with even greater ease. The coal paste or tar is mixed with hydrogen and pumped into preheaters and subsequently into liquid-phase converters, the products being taken out through a hot catch-pot and a cold catch-pot, as indicated. The gaseous and volatile synthetic hydrocarbon products are separated and sent to the refinery, while the middle oil is rehydrogenated in a vapor-phase converter to yield additional light products. The heavy oil from the liquid-phase converter, after separation of the ash and unconverted solid residue, is recycled to prepare more coal paste.

The most recent proposal along these lines—underground gasification—would take coal gasification operations to the unmined coal. While this most recent approach has only been tried experimentally in Alabama thus far (Chem. Eng., April 1947 pp. 107-109), and according to reports in Russia, its general objectives are evident. By this method it is sought to develop a water-gas process which would eliminate the costs of mining and transporting the coal, as well as a large part of the plant facilities involved in gasification above ground.

Chart 4, entitled "Underground Gasification and Catalytic Enrichment," illustrates one potential combination whereby steam and oxygen may be injected underground, gasifying the coal in place. The gas thus made would be a crude mixture of water gas and hydrocarbon gases. As shown in the chart, such gas could be used directly for industrial purposes, or it might be purified and further processed by catalytic enrichment to give high B.t.u. pipe-line gas, or perhaps converted into synthetic liquid fuels.

As the foregoing indicates, gasification research is today probing the broad field of technical possibilities for converting solid fuels into gas and liquid fuels, encompassing everything from the basic raw materials to the specifications and qualities of the finished gas and associated products. Further developments and refinements, both here and abroad, may be expected to continue. But to forecast at this time the outcome of these efforts would be to over-simplify an essentially complex and varied problem. The present situation is that the prospects for producing, in large quantities and at a low cost, a substitute for natural gas are improving. Only continued research and developmental efforts, and a favorable economic environment, can bring them to reality.

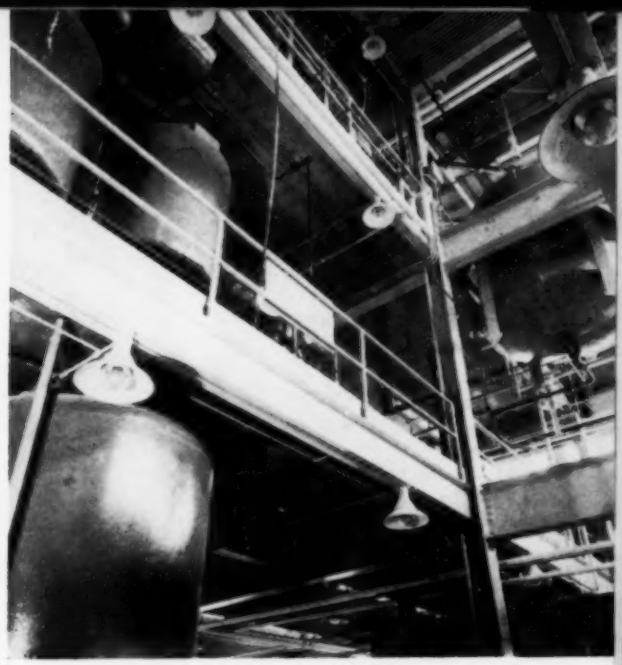
Economic Factors

A more imponderable problem, which cannot be answered so definitely as the technical one, is the economic factors that will determine the feasibility of coal gasification in competition with or as a replacement for natural gas.

The cost of producing natural gas in a given field generally increases with time, because of declining productivity and reduction in the use of the production facilities. As deposits become depleted in one area, the search must be extended and transportation costs may increase. With the trend toward deeper drilling, the cost of finding and developing additional reserves also may increase.

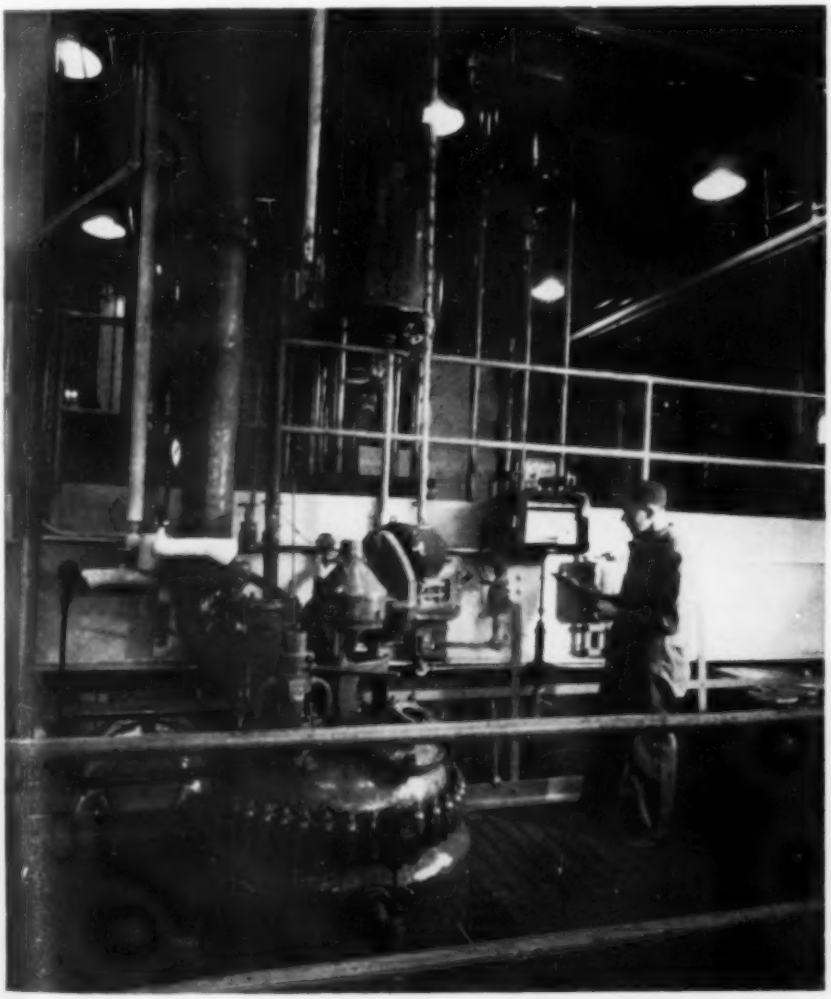
On the other hand, the coal supply in many areas is long-lived, and the technology of gas manufacturing is subject to cumulative improvements. Conversion costs become lower as better plants and processes are employed. Except for the cost of raw materials, the unit cost of manufacturing gas remains relatively stable and may even decrease, unless the economies are offset by higher coal, material and labor costs. Consequently, once the production of such gas is initiated, the prospects for continued operation and growth are favorable.

Development of synthetic chemicals requires large-scale reactors and receivers with storage capacities up to 2000 gal.



Equipment in the process building must be designed for maximum flexibility and versatility.

Building Flexibility into Semi-Works



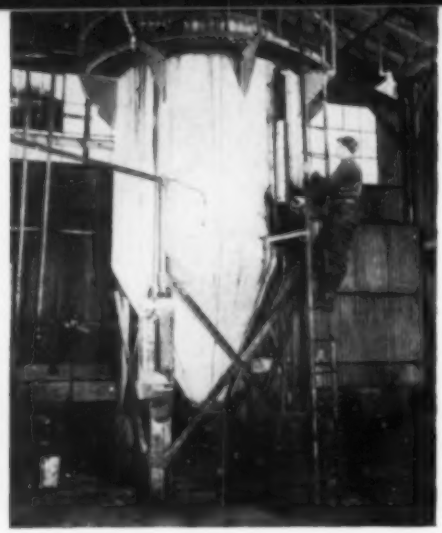
This all glass-lined reactor-still operates at pressures as low as 2 mm.

NEWEST developmental unit in the operations of B. F. Goodrich Chemical Co. is the experiment station recently completed at Avon Lake, a suburb of Cleveland, Ohio. It resulted from a conviction that a completely segregated plant employing up to production-sized equipment would permit most economical and successful development of new synthetic products and materials. It is supervised by chemical engineers who are interested in development work and have also had production experience. The plant is staffed by expert operators and specially trained mechanics who can contribute the maximum of flexibility and resourcefulness.

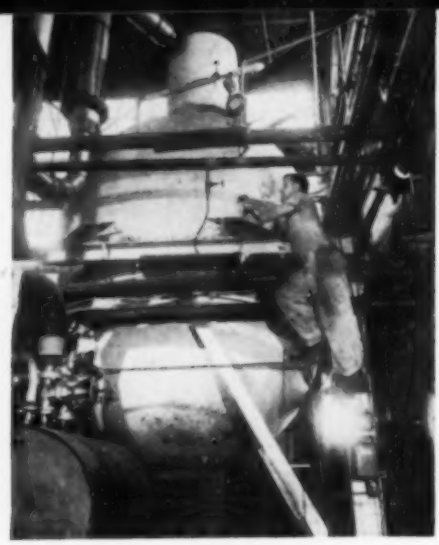
The Avon Lake Experimental Station was designed to handle development operations beyond those of the parent company's research and pilot-plant facilities, which are shortly to be centralized in the new laboratories now under construction at Brecksville. While the work at Avon starts at the laboratory bench, it quickly graduates to a micro-engineering scale in order to produce sufficient material for laboratory evaluations and process studies. Design engineers then lay out a flowsheet for semi-works production—the size of the plant being determined by (1) the information required by Engineering and Production for construction of full-scale operations and (2) the quantity of the new product requested by Development Sales groups for preliminary market evaluation.

Maximum flexibility and versatility are the keynotes in this unique plant which should do much to close the gap between fragmentary pilot-plant results and full-scale commercial production.

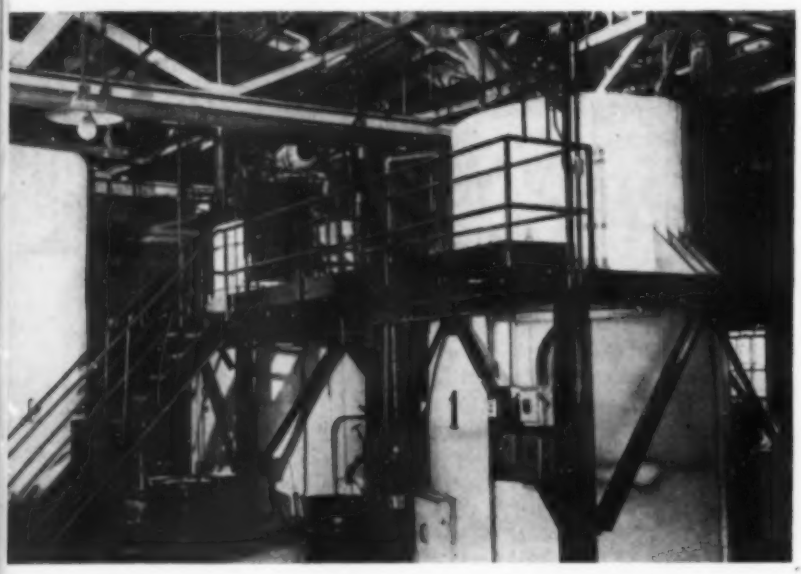
Monel Twitchell tanks where glycerine is split from fatty acids



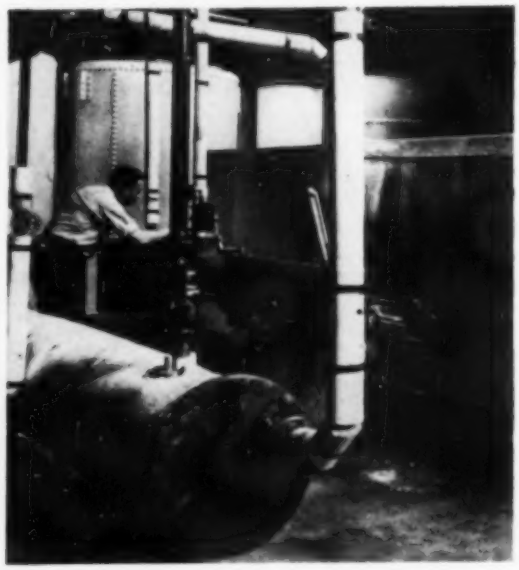
Autoclave for splitting tri-glyceride oils at pressures of 150-350 lb. per sq.in.



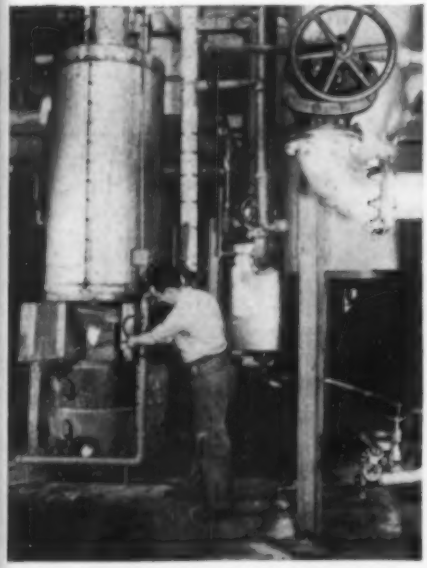
1,500 gal. batch distillation unit provides flexibility of plant operation



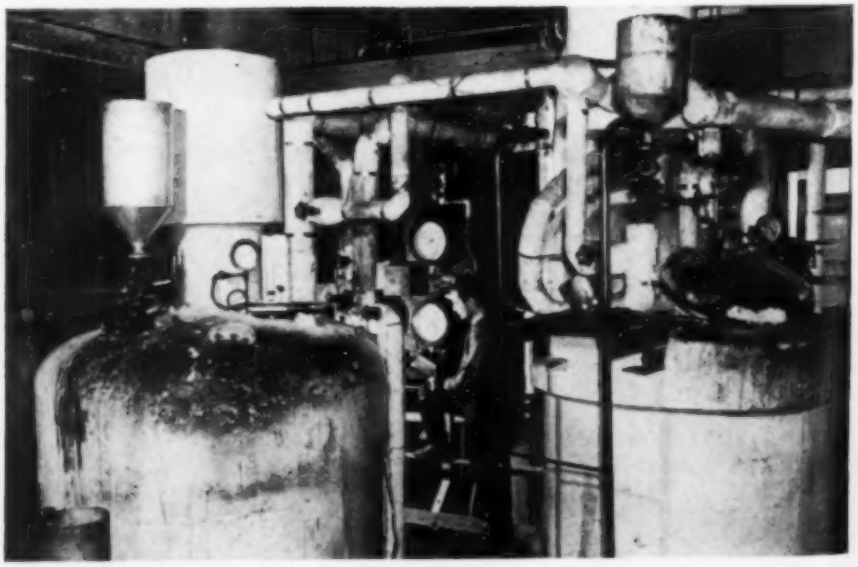
Tall oil fatty acid is esterified in automatically controlled kettles for use in paints, varnishes, grinding liquids and core oils



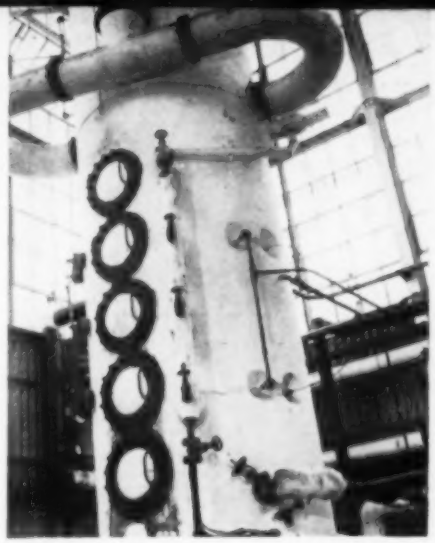
Linseed and soya oils are processed under high pressure in this specially designed pump



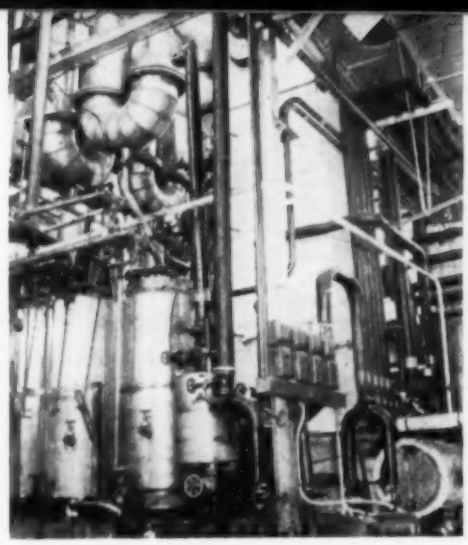
Before dehydration oils must be preheated; this is a standby unit



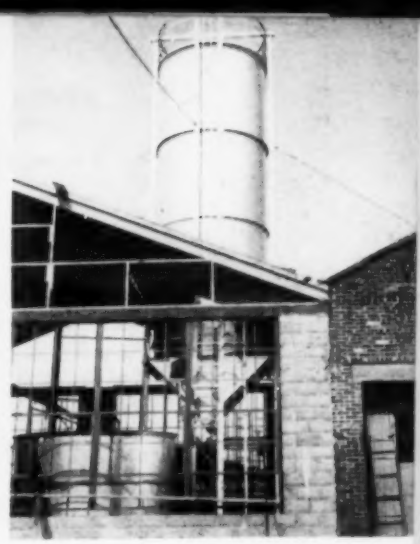
Castor oil is converted to a drying oil by dehydration under high vacuum and high temperature, in the presence of a catalyst; this changes its molecular structure



Fatty acids are continuously distilled in electrically heated vacuum towers



Special alloy condensers and receivers help insure color-free, distilled fatty acids



Spray tower in which liquid stearic acid is powdered

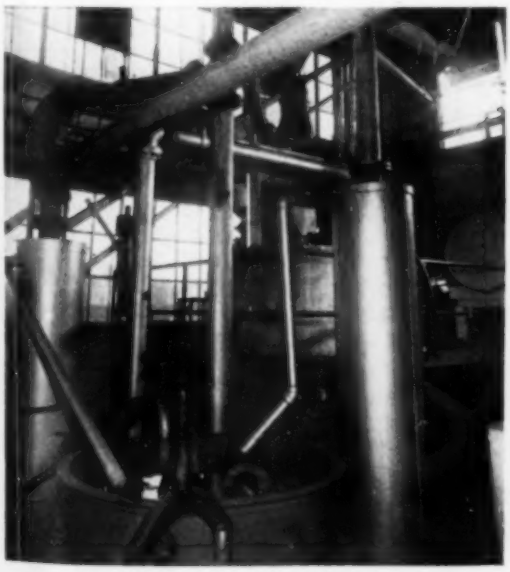
Processing Vegetable Oils

PRODUCING a wide variety of fatty acids, drying oils and other organics, Woburn Chemical Corp., Kearny, N. J., played an important part in overcoming wartime shortages of many materials, from tung oil substitutes to vitamin-containing oil concentrates. Using raw oils of all kinds, as well as residue soap stock from edible oil processes, this company pioneered in developing and producing specifications fatty acids for use in products such as synthetic resins, soaps, cosmetics, rubber, synthetic detergents and emulsifying agents.

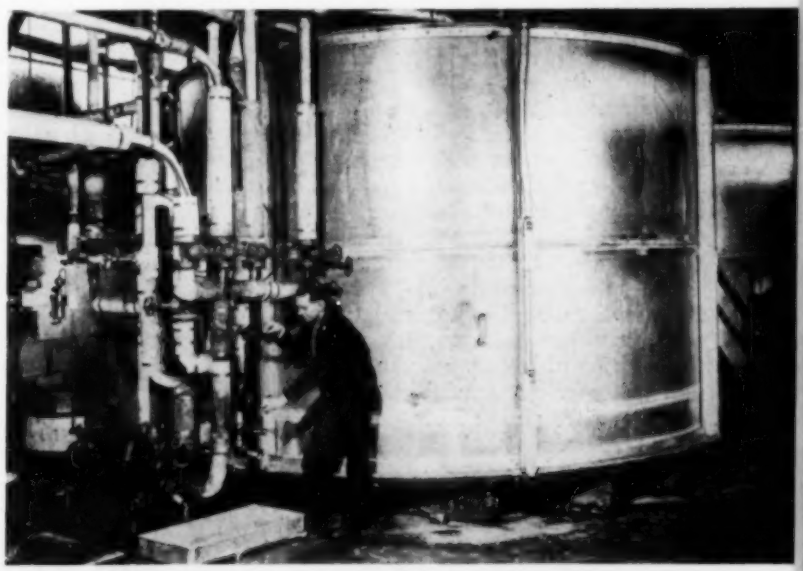
First step used in producing fatty acids is to remove the glycerine by splitting, accomplished here by both the Twitchell process and the autoclave or pressure process. The glycerine waters are then concentrated and the fatty acids are distilled by either a batch or continuous process. This separates the pure acid mixtures from the pitch or residue which is sold to manufacturers of floor and roof coverings. The purified fatty acids are marketed as is, or in certain cases, processed further.

A number of other processes are used in this versatile plant. It was the first United States plant to develop and commercially produce vacuum dehydrated castor oil to replace scarce tung oil for use in paints and resins. Catalytically isomerized linseed and soybean oils are also effectively processed into quick drying oils. Esterfied tall oil is produced for use in paints, varnishes and grinding liquids. Various other types of fatty acids are also esterfied.

Materials of construction used to combat the severe corrosion by fatty acids include Monel metal, stainless steel, Inconel and for some purposes, aluminum. Accent on production of pure, color-free products dictates the use of corrosion resistant equipment throughout the plant.



Fatty acids released in the dehydration process are cooled and recovered in this condenser unit



Special corrosion-resistant blending tanks where finished liquid products are mixed and measured prior to shipment

EVALUATING Materials Handling Layouts

WILBUR G. HUDSON
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CASE HISTORIES, EXAMINED AND ANALYZED BY AN EXPERT, REVEAL DIFFERENT WAYS IN WHICH SOLIDS MAY BE HANDLED

USUALLY there will be several possible solutions to a given materials handling problem and the manufacturer will ordinarily give weight to the preference of the user if there is no objection to it, since the latter, after all, is paying the bill. Still, the user will do well before insisting on his preferences to learn all he can from the experiences of the manufacturer, especially facts with respect to the cost of upkeep. Then in making his final decisions he must bear in mind the admitted fact that manufacturers, who are also human, are inclined to shade their own judgement in favor of the equipment types with which they can compete to best advantage.

Consider a recent problem of handling 85 tons per hour of light soda ash (38 lb. per cu. ft.), at a temperature of 400 deg. F., between two buildings of the plant, a distance of 90 ft. with a lift of 8 ft. It would be necessary to house the conveyor because of its out-of-doors location. Three possible methods are suitable, including: (1) A standard 20-in. steel-flight screw conveyor with cover plate, run at 70 r.p.m., with a 20-hp. motor; (2) a double-strand flight conveyor with 20 x 8-in. flights spaced 12 in. between two strands of 6-in. pitch rivetless chain, operating at 75 ft. per min., with a 10-hp. motor; and (3) a continuous-flow conveyor with a duct cross section of 189 sq. in., with $\frac{5}{16}$-in. side and cover plates and $\frac{1}{4}$-in. bottom plate, operated also at 75 ft. per min., with a 20-hp. motor. The prices are approximately in the proportion of 30, 45 and 58.

A 24-in. belt conveyor at 250 ft. per min. would do the job with a much lower power requirement, but the 400 deg. temperature of the soda ash eliminates it from consideration. This matter of high temperature also favors the flight conveyor in which the chains are not in direct contact with the material, as contrasted with the continuous flow machine in which the chain is submerged and will reach a temperature approaching that of the material—dangerously high for malleable iron. The continuous flow conveyor has one advantage compared with methods (1) and (2). Its duct forms a box girder with a depth of about 20 in. which can readily span the 90-ft. run (which, less end bracing, becomes about 70 ft. net). Methods (1) and (2) both require a supporting bridge. The screw conveyor has the advantage of lowest first cost and simplicity. However, the helix and its bearings will require renewal more frequently than the moving parts of the flight conveyor.

Bulk Unloading

Unloading of bulk material from box cars has interesting possibilities. For material which is suitable and where the required unloading rate is not too great, the pneumatic unloader has more desirable features than is usually appreciated. The flexible hose with its automatic nozzle control, is introduced into the car over the top of the car-door bulkhead which thus remains intact. If the hygienic requirements are strict, risk of contamination is much less as compared with the operation of a power shovel. With finely pulverized material the dust is sucked into the nozzle instead of being scattered about. A curious, and not altogether secondary factor, is that as an alternative to manual handling, the saving in cost can be shared with the laborer and it makes him, at least in his own opinion, a "skilled operator". That means labor easing and reduced turnover.

Free-flowing granular and pulverized materials are handled satisfactorily unless the jostling in the duct causes objectionable degradation; thus with oats the sheath tends to crack open at the tip of the grain. Carbon black pellets are too fragile to be so handled. Most of the briquetted materials suffer damage and would require re-screening. There are border-line materials, sometimes suitable and sometimes not, as for example fuzzy cottonseed. Manually, this can be forked into wheelbarrows. With a pneumatic unloader the inter-locked mass must be hoed into the nozzle. Observations in the south showed four men unloading 104 tons in 10 hours, or 10.4 tons per hour. With a pneumatic unloader, two men unloaded 10.5 tons per hour with a power input at the exhauster of 31 kw.

Assuming labor at $0.50 per hour and power at $0.03 per kw.-hr., the

Is a pneumatic unloader satisfactory for handling carbon black pellets? How can soda ash at 400 deg. F. be handled successfully, or the destructive action of other corrosive or abrasive solids be prevented? For these and other materials handling problems various solutions are discussed and appraised in this authoritative article.

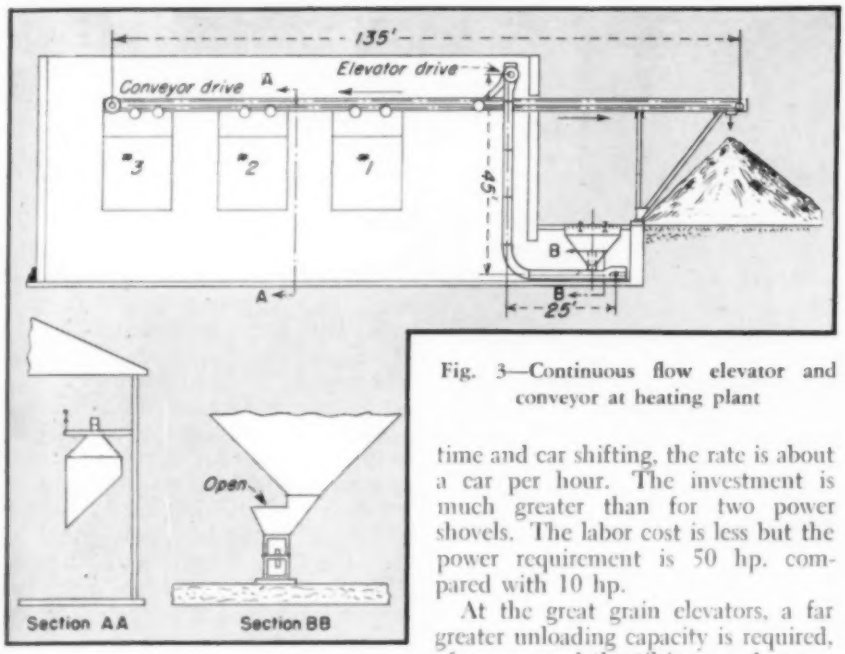

Fig. 3—Continuous flow elevator and conveyor at heating plant

comparison appears unfavorable to the machine. With manual handling cost at $0.19 per ton, pneumatic handling figures labor at $0.095 and power at $0.09 or a total of $0.185 per ton, to which must be added an allowance for depreciation and maintenance of the machine. However, in using the pneumatic unloader the job involves two men instead of four and work inside the hot car is more bearable due to the active ventilating action of the air sucked into the nozzle.

Unloading grain from box cars is a common problem. With power shovels (Fig. 1) two men in the car maintain a rate of 1,250 bu. per hour, including the time of breaking out the door bulkheads, car shifting and clean-up. That is a little less than a car per hour. A pneumatic unloader will provide a free-digging capacity (without clean-up) of 2,000 bu. per hour, with a 50-hp. exhauster. The door bulkhead remains intact. If we include clean-up

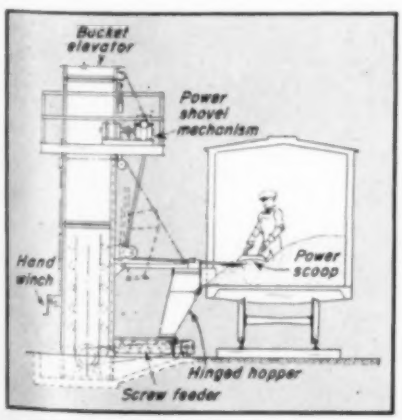

Fig. 1—Power shovel operating layout

time and car shifting, the rate is about a car per hour. The investment is much greater than for two power shovels. The labor cost is less but the power requirement is 50 hp. compared with 10 hp.

At the great grain elevators, a far greater unloading capacity is required, of course, and the tilting car dumper, costing about $125,000 is standard equipment. Under favorable conditions an average rate of nine cars per hour can be maintained with a crew of four men, representing a labor cost of $0.45 per car at $1 per man-hour. Maintenance cost runs about $0.03 per car.

The occasional failure of an installation to come up to expectations is more often due to inaccurate information contributed by the purchaser than to error on the part of the manufacturer. Sometimes there is failure by both to foresee the rather obvious. Fig. 2 shows one such instance. Mine car loads are dumped to a shaker screen to cull out about 10 percent of slack and chute the remainder into railroad cars for shipment. Thus a belt conveyor and elevator good for 35 tons per hour were specified for the screenings. The dumping rate was stated to be 200 tons per hour.

So long as the stated conditions held, the installation functioned perfectly, but at irregular intervals the men back in the mine loaded cars with small stuff, nearly all of which passed through the screen. It immediately was evident that the capacity of the belt conveyor and elevator must be close to 200 tons per hour to prevent such surges from swamping these units and backing up into the screen. The equipment was re-built for that capacity.

Handling Headaches

Although projects involving the handling of coal constitute the majority of the activities of the materials handling engineer, the chemical industry, food products industries, and various industrial processing work contribute by far the largest proportion of headaches. Aluminum oxide, bauxite, borax, cullet, feldspar, glass batch, lead sulphate, the metallic dusts, molybdenum concentrates and silica sand manage to work into chain joints to start and maintain active cutting action. Damp acid phosphate, ammonium nitrate, bentonite, copra meal and soybean expellor foots adhere to flights, build up in elevator buckets and choke discharge chutes. Either corrosive or abrasive characteristics may provide difficult problems.

Cause and Cure

In a stockyards apron conveyor handling bone scrap, the leached liquor corroded the malleable iron chain so rapidly that it was practically finished in six months. A continuous-flow elevator handling hot spent brewers grains had the malleable iron chain destroyed in three months due to the corrosive action of lactic acid. And yet,

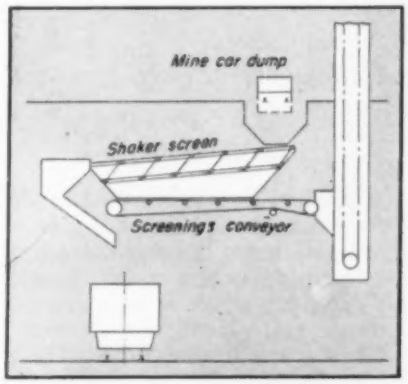

Fig. 2—Shaker screen, screenings conveyor and elevator at mine dump

malleable iron, especially with a copper content, has much better resistance to corrosion than steel and if hot-dipped or plated with cadmium or zinc the resistance to mild corrosives is vastly improved. However, these platings when dissolved have a toxic action and cannot be used where food products may come in contact with them. Moreover the plating wears off in time.

Manganese bronze has good resistance to corrosion from nearly all fruit and organic acids, but is vulnerable to nitric acid. Chains of stainless steel with molybdenum or copper content are nicely resistant to fruit and all organic acids but are extremely expensive. In general the simple chains such as the detachable-link belting and the forged rivetless type are best where corrosive

action is expected. The best chain cannot be readily determined by laboratory tests and it is preferable to rely on the recommendations of a responsible manufacturer and let him take the responsibility.

In heavy-duty conveyors and elevators there is a factor quite distinct from chain corrosion and abrasion which sometimes causes trouble. Under heavy pressure at the drive sprockets, actual seizure sometimes occurs between the links and sprocket. This commonly is called galling. Possibly this is molecular seizure of metals of the same or similar composition when the contacting surfaces are absolutely clean and in direct intimate contact under pressure. The slightest film of lubricant will eliminate the possibility of galling and thus a coating of 0.0003 in. of cadmium prevents galling under pressures as high as 25,000 lb. per sq. in. of bearing area. Abrasion occurs where a grinding agent is present between two surfaces in motion. Galling can occur only when the surfaces are in direct contact. Although a lubricant may or may not reduce abrasion, it does prevent galling. When small areas of the surfaces under pressure-contact have broken through any residual separating matter, destructive action may begin.

Coal Handling

In coal handling both corrosion and abrasion may occur. Corrosion usually is the more destructive especially when the coal is damp or wet. With sand and gravel the reverse is true; abrasion is the destructive factor. In either case the harder steels such as Corten may be specified for the conveyor trough plates.

Fig. 3 outlines in part a wartime heating plant which was equipped with three stoker-fired boilers, one a spare, and using one carload of minus 2-in. clean dry coal per week on an average. The government specified continuous flow equipment and a capacity of 50 tons per hour, dustless operation and a moderate reserve storage primarily to take care of part of a carload should the bins fill.

As designed, there were three covered bins, one for each boiler, a 12 x 12 ft. track hopper with grid and a direct feed to the horizontal leg of an L-path elevator. It was desirable to facilitate the removal of wood or other troublesome materials passing through the grid, so the detail (Sect. A-A) was adopted for easy access where jamming usually occurs. For 50 tons per hour and a moderate speed of 50 ft. per min. a duct cross section of about 120 sq. in. is required.

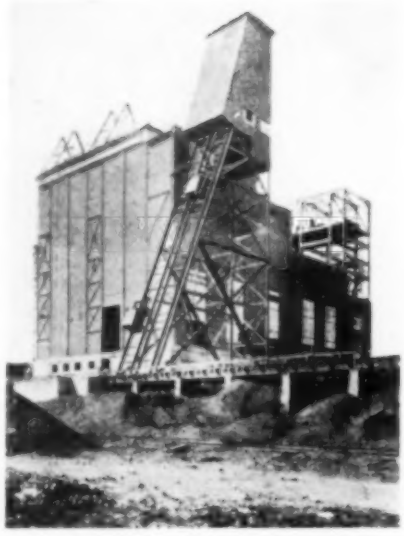

Fig. 4—Balanced skip hoist for 150 tons per hour

The motor horsepower, *MHP*, of the elevator is given by the formula

$$MHP = TPH\ (H \times 0.0032 + V \times 0.003)\ C$$

where *TPH* is tons per hour, *H* is the length of the horizontal leg and V is the length of vertical run. The constant C for slack coal is 1.2, so we have

$$MHP = 50\ (25 \times 0.0032 + 45 \times 0.003)\ 1.2 = 12.9 \text{ hp. for the motor.}$$

For the distributing conveyor we discharge from the elevator to the top run, carry out to the far end, drop the coal to the return run, from which it passes out wherever there is space in the bins, while the surplus, if any, is carried out to reserve storage. The elevator and conveyor details are interchangeable, except that the conveyor has 10 percent higher speed for easier loading along the duct. The motor horsepower for the conveyor (where the adjusted load-run length is 112 ft.) is given by

$$MHP = TPH\ (H \times 0.004)\ C = 50 \times 112 \times 0.004 \times 1.2 = 26.9 \text{ hp.}$$

Coal from reserve may be pushed over into the track hopper and frozen lumps broken up on the grid.

This is a satisfactory low cost installation since the coal is neither abrasive nor corrosive. It fulfills the requirements with only two units and does not require a feeder. The automatic dual function of the conveyor discharge to bins and surplus to reserve storage is an operating advantage. The power requirement is high, which may or may not be objectionable. However, alternate methods also have their disadvantages, frequently including higher investment cost.

Fig. 4 shows a stoker equipped plant where coal is received in cars on a trestle about 18 ft. high, beneath which dead storage is maintained. Here the conditions are quite favorable for a skip hoist. True, the track hopper, loader and bucket in loading position for the desired capacity of 150 tons per hour call for a depth beneath the rails of about 28 ft., but this is offset by the trestle height. The lift is 160 ft. A single-bucket, full-automatic, counterweighted skip with 4-ton bucket, geared to 260 ft. per min. with terminal slowdown, has a capacity of about 180 tons per hour and requires 73 motor horsepower. A two-bucket or balanced skip with 2-ton buckets has a capacity of about 170 tons per hour with the same speed and motor horsepower, and requires a lighter hoist machine unit. Another advantage of the two-bucket hoist is that the track hopper with its twin discharge openings may have a greater length for the same depth. A four-pocket, 70-ton car requires a track hopper length of 18 ft. if it is to be emptied without shifts.

Elevator vs. Skip Hoist

As an alternative to the skip hoist we have the continuous bucket elevator with 24 × 12 × 17-in. buckets at 100 ft. per min. A vertical path is better than an inclined path which introduces rollers and supporting rails along each run. It requires less power than the skip. Its motor horsepower can be approximated as twice the lift times the tons per hour, divided by 1,000, or 45 hp. to which must be added about 10 hp. for a feeder. Either machine will do the job. The skip will cost substantially less.

There is no substantial difference in desirability between the two layouts. The skip has few moving parts and requires little maintenance beyond an infrequent reversal or replacement of the wire ropes and a check-up of the loader and controls. The straight inclined path is a favorable circumstance as it involves a minimum number of rope bends. The two-speed motor assures a gentle engagement with the pivoted loader and a smooth tilt of the buckets when unloading.

The vital part of a bucket elevator is the chain. If it is to have a long life the pins should be of high-carbon, heat-treated steel, locked rigidly in the outer bars. The bushings should be case-hardened carbon steel secured in accurately fitted broached holes in the inner bars. As the element rounds the foot wheels some fine dust presses into the usual grease nipples and it is better to have plugs in the pin-ends and remove these when it is desirable to force in lubricant.

FILTER TYPE DUST COLLECTORS

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THROUGH NEW DEVELOPMENTS AND INCREASED EFFORT FILTER TYPE COLLECTORS HAVE SOLVED NEW PROBLEMS WITH HIGH EFFICIENCY

INDUSTRIAL DUSTS and their prevention or collection have become a major problem for many companies, and industry as a whole is engaged in a determined effort to clean up the air in and around its plants. Outside forces, such as community groups and labor unions, have been exerting considerable influence on this movement; however, the greatest impetus is coming from the realization that these "nuisance" dusts frequently constitute a marketable product with very real profit possibilities.

New Successes

Partly as a result of wartime developments in collector materials, but principally because of the increased efforts being directed at the problem, many of the dusts which for years have defied efficient and economical collection are now being handled with complete success and many companies are collecting a very neat revenue out of material which formerly was dissipated over the surrounding community.

One of the oldest and most widely used varieties of dust collectors is the filter type. These collectors are serving a wide variety of uses in practically all industries. They are built in several different forms by as many different companies but all employ the same principle of passing the dust laden air through a filtering medium, such as cloth, which retains the dust and permits the air to pass through.

There has also been developed a wide variety of collectors based on physical principles other than filtration. These include such well-known and widely accepted varieties as the centrifugal or "cyclone" collector, the electrostatic collector, the liquid or "spray" type collector and others embodying combinations of the principles listed above. Each of these collectors has certain advantages and disadvantages and gives excellent results when properly applied and designed. The present paper, however, will be devoted almost exclusively to a discussion of filter type collectors.

In many of the cases where filter type collectors have been tried and found wanting, their failure has not been a result of faults inherent in the principle of filtration but rather because of a misapplication of that principle. This article has been written in the hope of clearing up some of the misunderstandings and misconceptions generally associated with filter type collectors and also to point out a few of the new developments which have materially increased the scope of applications for this equipment.

Filter Cloth

The first thing that should become clear to anyone considering a filter is that filter cloth, or dust collector cloth, does not in itself collect dust. Rather, it is a framework on which a filter "cake" is permitted to build and that filter cake is the material that does the dust collecting.

It is a frequent experience in hydraulic filtration (the filtering of solids out of liquids) that the first liquid to be passed through the filter medium does not run clear and that it does not begin to run clear until a filter cake or encrustration is built up on one side of the medium. Hence, in a chemical filtration it is usually the custom to re-filter the first filtrate. The separation of solids from air or gas is no different, and the same problems prevail.

Cloth Constructions

This statement that the cloth is not the filtering medium can be readily understood if we examine a piece of ordinary filter cloth under a microscope. The holes between the threads are obviously much larger than the dust particles to be collected.

Fig. 1 represents a magnified cross section of a dust collector cloth that is known as "five harness warp sateen" and is the type most generally used for dust collectors. The cross-hatched lines represent the warp threads in the cloth construction and the two lightly shaded lines represent what are known as the filler threads. It

Some engineers are still not aware that unrealized profits now being scattered across the landscape as nuisance dusts can be captured by dust collectors. However, all engineers faced with problems brought about by dust will be interested in this discussion of the theory, applications and recent developments of filter type collectors.

will be noticed that the filler threads predominantly "ride" on one side of the cloth. This type of construction presents a herringbone appearance on the side of the filler threads. It is known as the "face" of the cloth.

This side of the cloth is the proper side for filtering; that is, the side on which the filter cake should form. There are several reasons for this: First, the filler threads are usually softer yarn; they are not twisted as strongly as the warp threads and hence, being softer, they are more permeable to the flow of air. Second, the relatively long distance between points at which each yarn is fastened permits greater "throw" when the cloth is shaken to free the accumulated cake.

It might be reasoned that if a soft face is good, a much softer face would be better. This is not necessarily true but rather depends upon the type of material being collected. Fig. 2 represents a "canton flannel" construc-

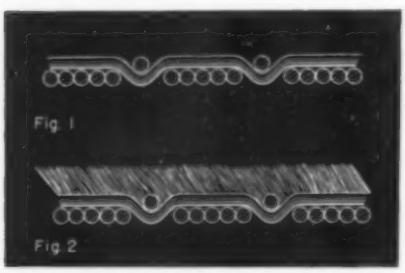

Fig. 1—Cross section of five harness warp sateen filter cloth showing type of construction used; cross hatched circles represent warp threads, while filler threads are shown lightly shaded; top of the material is face of the cloth

Fig. 2—Same material as in Fig. 1 after napping to form "canton flannel" cloth: the hairy face is the side on which the filter cake ordinarily builds; here fibrous materials may become so entangled that they cannot be shaken loose

tion which has been napped, or made hairy, on the face side. Such a construction has advantages in connection with granular materials which will not interlace and interlock themselves with the hairy napping. One reason for napping some materials is to present a surface which will absorb shock when used in the presence of sharp, hard, granular abrasive particles; but when dealing with a fibrous material, no matter how short the fibers may be, we have a material which will interlock and interlace itself with the napped thread and present an almost impossible problem for eventually releasing the material from the cloth. It will be seen from the above that no set rule can be laid down for fabric construction but each case must be decided in the light of its own problems.

Another material which would seem to possess decided advantages as a filter material is felt. Fig. 3A illustrates the construction of a felt filter cloth. It is composed of a mass of individual fibers gathered together in a rather helter-skelter fashion and then pressed under various degrees of pressure and temperature, with or without adhesive, and it makes what is essentially a filter cake itself.

The principal difficulty encountered with felt is that the dust penetrates into the hairy structure and some of it always remains after the cleaning operation. This permits driving the residual dust deeper into the cloth structure making it eventually impermeable and uncleanable. This is illustrated in Figs. 3*B* and 3*C*.

There are, of course, many other types of cloth which can be and have been used as dust filters; for example: asbestos and the various synthetic fabrics (rayon, nylon, etc.) but, generally speaking, they are all subject to the types of construction referred to above. Each of these has certain advantages of its own such as resistance to high temperature or acids, and usually they have certain disadvantages such as high cost or low strength.

Methods of Cleaning

The next important question to be considered in the choice of a filter type collector is the method used to clean the filter cloth. The most common method of cleaning filter cloth is by a shaking or beating mechanism and this is certainly the most satisfactory if properly designed. Some of the important points to be considered in evaluating any shaking mechanism are the following: (1) All or most of the power consumed should be transmitted directly to the removal of the dust cake from the cloth and should not be absorbed, in the form of shock, by the shaking mechanism and the dust collector springs. (2) The shaking action should be such that the bulk of the dust is removed rapidly and efficiently without getting the filter cloth too clean. Attention is again drawn to the fact that it is the filter cake and not the filter cloth which does the actual filtering operation. For that reason it is desirable that a small amount of the filter cake be left on the cloth after the shaking operation, the only purpose in the cleaning being to reduce the back pressure of the

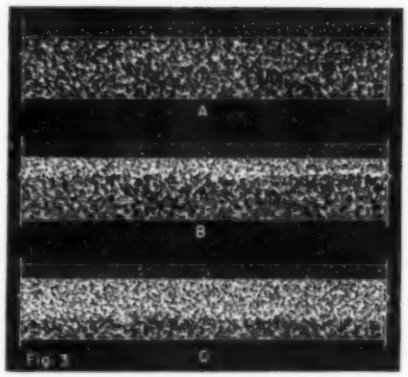

Fig. 3—Cross section of felt filter cloth at various stages of use; (A) shows the cloth when the cake has just started to form; (B) when it has been in service for some time; and (C) when extended use has caused the pores to become almost completely plugged

collector to an economical figure. (3) The shaking action should be such that it does not damage the filter cloth by excessive stretching, tearing or abrading and should insure a long cloth life. All of these requirements are available in cloth type dust collectors on the market today.

One method of cleaning filters, that is still being used occasionally, is that of using a reverse air flow during the cleaning cycle. There are certain serious disadvantages to this practice. The first and most obvious disadvantage is that a reverse air flow gets the filter so completely clean that it will be free of the very necessary filter cake which prevents exfiltration of the pathologically dangerous fine particles. One characteristic of a filter which has been cleaned by reverse air flow is that when the filter is put back in the line, a puff of dust can be seen coming through the collector when the filter cake first starts to rebuild. Second, unless the reversing air is completely clean, a layer of dust will be deposited on the outside of the bag and this dust will later be blown over the working area when the bags are in normal operation. The third problem is that of insuring that the reversing air does not contain moisture which, when mixed with many forms of dust, forms an almost irremovable cake which greatly reduces the efficiency of operation of the collector.

Air-Cloth Ratio

Another important question in dust collector design is that of determining the proper ratio of air quantity to cloth area for a given operation. This, of course, varies with the type of material being collected, the condition

of the material, (moisture, temperature, etc.), the type of cloth used, and the frequency and thoroughness of cleaning. It can be determined only by experiment for any given set of conditions. It is important that the air-to-cloth ratio be as high as possible since the cost of the equipment is directly related to the number of square feet of cloth required. On the other hand, the ratio must not be too high or the excessive back pressure developed will result in excessive power cost and inefficient operation.

Maintenance

Maintenance is always an important problem in the operation of any type of equipment and this is especially true of filter type dust collectors where the filter cloth must be changed periodically. There are many variations of design for suspending the filter cloth in the path of the dust laden air, the simplest of which is the bag-type collector, an example of which is shown in Fig. 4. Bag type collectors are ordinarily subject to considerably less wear than the other filter type collectors and the bags are usually much easier to change when they have served their useful life.

In designing a bag type collector, it is important that the proper bag proportions be maintained. As a result of a great number of experiments conducted over the years while metallurgical bag houses have been in use, a rule of thumb has been developed that can be depended on with reasonable confidence. This rule is that the length of a bag shall never be greater than 30 times its diameter. The reason for this is that when a bag is shaken, no matter what the shaking mechanism is—be it a vertical, sidewise or rotating movement—it is essential that the bag be flexed and the tendency of a long narrow bag is to produce a trapping structure. This rule was developed for materials of a high specific gravity and by this is meant apparent specific gravity rather than real specific gravity. The lower the apparent specific gravity of the material being collected, the more important it becomes that we do not exceed the limits of safe bag length.

The figure given for the relation of bag length to diameter represents a compromise between two desirable factors — maximum cloth area per square foot of floor space, and maximum cleaning action. If the bag length is decreased in relation to the bag diameter, it is obvious that more bags will be required for the same cloth area and hence more space will be occupied, which will mean more gathering hoppers and conveyors.

Proof of the Pudding

Like any industrial equipment, cloth filter type dust collectors have their limitations and there are certain applications for which they have not proved successful. However, many dusts which have heretofore been considered "impossible" for cloth type collectors to handle efficiently are now being collected successfully and it might be well to mention briefly a few of them at this point.

Fibrous Materials—Asbestos, one of the fibrous materials that has for years defied successful collection, is now being collected in a cloth bag type dust collector to the complete satisfaction of everyone concerned. In one collector 22 tons of asbestos is being collected every day and there has not yet been a single case of the collector clogging and failing to clean itself satisfactorily during the shaking operation. In fact, during tests made in a pilot installation, asbestos was actually shoveled into the dust collector system until the bags were completely stuffed and yet the system cleaned itself thoroughly in a matter of seconds during the normal cleaning cycle.

Extremely Small Dust Concentrations—A problem recently encountered was that of filtering city air with a dust count of 0.0004 grains per cubic foot and cleaning it to a point where the maximum dust concentration was 0.000002 grains per cubic foot. Since it was obvious that, on dust concentrations such as these, the time required before a filter cake would be built up would be terrific, it was decided to try using a filter aid in the dust collector system. When the dust collector was first hooked up into the system asbestos floats were shoveled into the collector in sufficient quantity to build a filter cake on the inside of the tubes. The city air which was to be cleaned was then sent through the dust collector system and analyzed on the clean air side. It was found that the dust concentration had been reduced to 0.0000015 grains per cubic foot. It was also found that the dust collector could be left in operation a week at a time before it was necessary to shake it down and add new asbestos for the next cycle.

High-Temperature Dust—As a result of war time developments in dust collector fabrics, it is now possible to use filter type collectors for high-temperature, highly acid dust. One recent installation which has been extremely successful is the collection of carbon black at a temperature in excess of 350 deg. F.

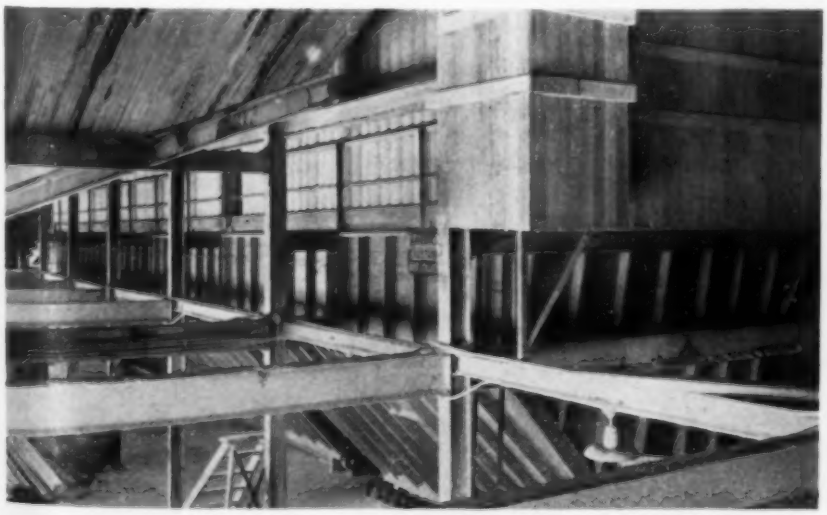

Fig. 4—Cloth bag type filter installed at Johnson Co., Ltd., Thetford Mines, Que., which collects in excess of 20 tons per day of asbestos floats

Where Know-How Counts

While it is true that a square foot of cloth, as such, will do no more for one person than it will for another, the difference between success and failure in a dust collector installation lies in the way that the square foot of cloth is used. The brief discussion given here is not meant to cover all of the details of dust collector design but merely to serve as a guide or check list when considering the application of a dust collector to some specific problem. In all cases it is good practice to consult a manufacturer with experience in the particular problem in hand.

The 21.4 cu. yd. bucket of this Bucyrus-Erie dragline, one of the largest in the phosphate industry, takes a 30-ton bite in stripping overburden or scooping up matrix at the Peace Valley plant of International Minerals & Chemical Corp.

Mining and Processing FLORIDA PHOSPHATE

FLORIDA'S TEN PHOSPHATE PRODUCERS ACCOUNT FOR MORE THAN 40 PERCENT OF THE PRESENT WORLD OUTPUT OF ABOUT 12 MILLION TONS

PHOSPHATE ROCK mined and processed at Peace Valley and Mulberry, Fla., by the Phosphate Division of International Minerals & Chemical Corp. is of the land pebble variety found in central Florida. High in grade (30 to 36 percent P_2O_5), the pebble phosphate constitutes the largest part of the production. It contains 70 to 80 percent of tricalcium phosphate, together with such impurities as clay, limestone, sand and calcium fluoride.

Florida land pebble rock is found on the bottoms and along the banks of rivers and lakes. The pebbles on the river bottoms are gathered by scoops; the banks are mined hydraulically. At International's Peace Valley mine, large electrically operated dragline shovels scoop off the overburden and dig out the pebbles of phosphate which are incased in a clay matrix.

The shovel dumps the matrix into a sump where a hydraulic monitor breaks it up and slurries it so that it can be readily pumped to the washer and flotation plant. The slurry is handled in large volumes of water.

In the matrix the phosphate varies in physical character from pebbles several inches in diameter to fine slimes. Matrix chunks, known as "mud balls," are broken up, the coarse material separated from the fines and the slimes. The slimes, below 200-mesh, are then separated from the fines and the latter beneficiated by flotation in the Peace Valley plant.

Following beneficiation, the phosphate rock is sent by rail to the blending, drying and grinding plant at Mulberry, Fla., where it is made ready for shipment.

Both domestic and foreign demand for phosphate rock has been climbing at a surprising rate in the last five years. Producers in the United States, beset by box car shortages and a limited supply of sulphuric acid for acidulating, have been chiefly supplying domestic demand, giving little attention to foreign inquiries. Time will be required to build and to get into opera-

After beneficiation, the phosphate rock goes by rail to the blending, drying and grinding plant, where it is readied for shipment. This is a typical dryer installation at the Mulberry, Fla., plant of International (left)

▼

Raymond grinding mills at the Mulberry plant grind phosphate rock to the fineness required for acidulation (right)

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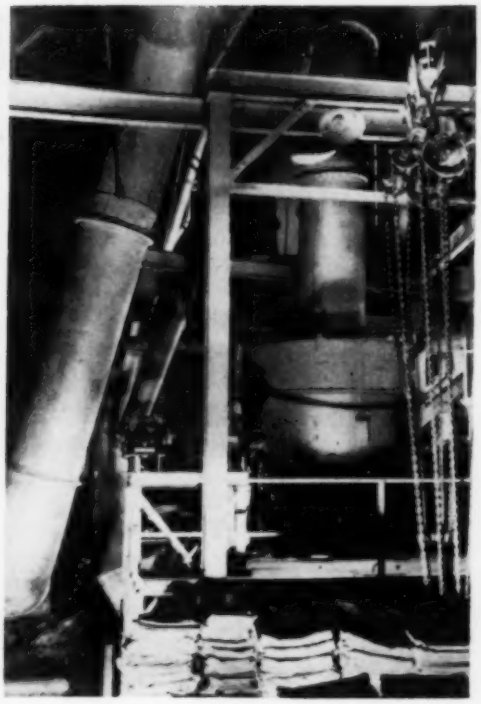
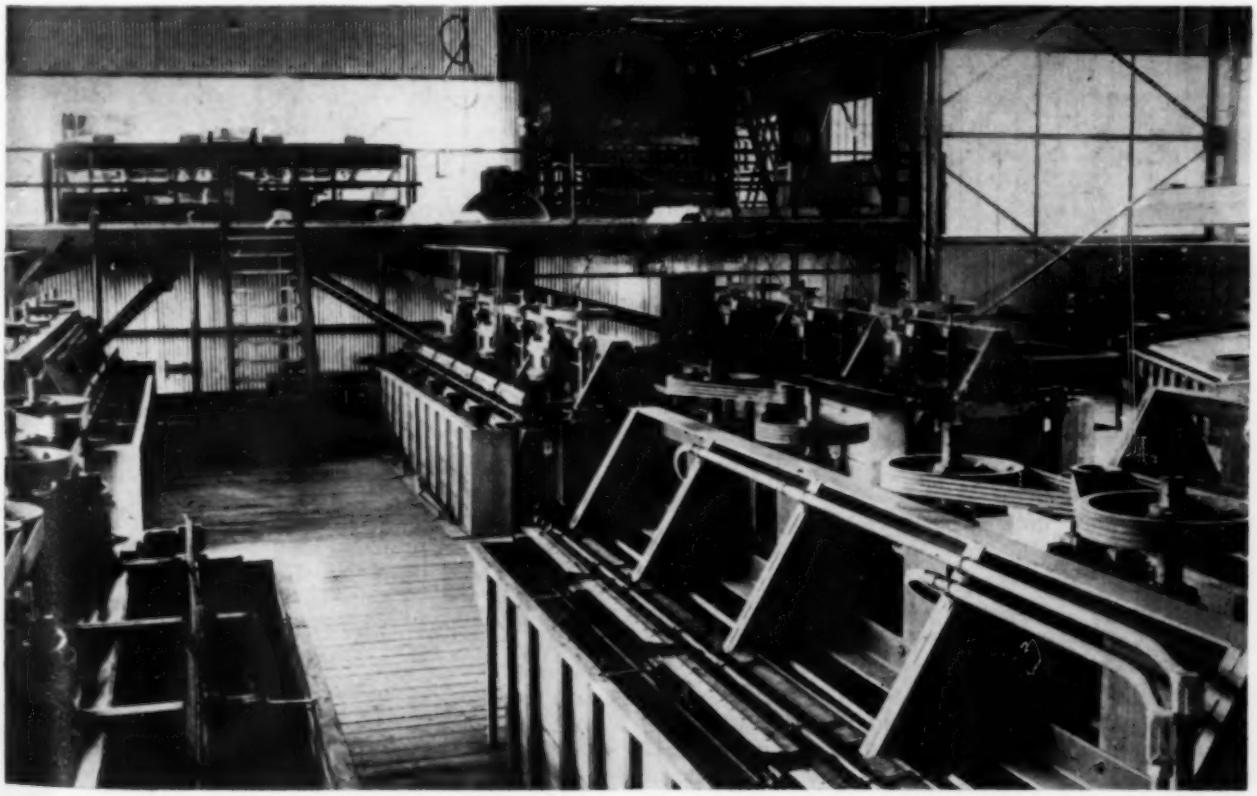


tion such projected new capacity as the Noralyn plant of International Minerals & Chemical Corp. at Bartow, Fla. Meanwhile African phosphates, produced in French government-controlled mines in Morocco, Tunis and Algeria, have practically absorbed our pre-war European markets.

Foreign trade in phosphates has in the past been a fairly large part of the market for Florida rock. Roughly 1 million tons was shipped annually to Europe, Japan and Canada in the pre-war years. This additional volume of output allowed producers to sell in the domestic market at lower prices because of lower costs. It is hoped this export market can be regained in due course for the same reason. World production of phosphate rock is back to the pre-war total of about 12 million tons. Of this total, Florida's ten pebble and hard rock producers account for more than 40 percent.



Fines from the phosphate rock slurry are beneficiated by flotation in these cells

EDITORIAL VIEWPOINTS

Sidney D. Kirkpatrick and Staff

ENGINEERS AND LABOR LAW

PROFESSIONAL employees get special recognition under the Taft-Hartley labor law. They can no longer be swallowed up, unwillingly, by a large bargaining unit where they would be greatly outnumbered by non-professionals.

"Professional employee" is defined as "(a) Any employee engaged in work (1) predominantly intellectual and varied in character as opposed to routine mental, manual, mechanical or physical work; (2) involving the consistent exercise of discretion and judgment in its performance; (3) of such character that the output produced or the result accomplished cannot be standardized in relation to a given period of time; (4) requiring knowledge of an advanced type in a field of science or learning customarily acquired by a prolonged course of specialized intellectual instruction and study in an institution of higher learning or a hospital, as distinguished from a general academic education or from an apprenticeship or from training in the performance of routine, mental, manual or physical processes."

Significantly, this definition then goes on to include those working under supervision with the objective of becoming a professional; viz. "(b) any employee, who (1) has completed the courses of specialized intellectual instruction and study prescribed in clause (4) of paragraph (a) and (2) is performing related work under the supervision of a professional person to qualify himself to become a professional employee as defined in paragraph (a)."

Beginning Aug. 22, the National Labor Relations Board may not certify a bargaining unit including both professionals and non-professionals unless a majority of the professionals vote for inclusion. In other words, they have the option of keeping their dealings with management separate from the other employees, thus being better able to negotiate to their own best interest.

In practice it may make little difference, because NLRB policy of late has been to separate the professional workers. There have been some instances, however, in which this was not done. So the provision in the law at least may assure a uniform policy.

It would appear, however, that the policy would not apply in a case where an employer voluntarily recognized a union as bargaining agent for both groups of workers, unless an employee or group of them subsequently challenged the majority status of the union and brought the Taft-Hartley law into play by petitioning NLRB for a "decertification" election. NLRB then could not poll the employees as to their bargaining preference without first determining whether a majority of the professionals, if they were to be included, approved of the act.

The new law cannot be expected to right all of the wrongs or solve all of the complicated problems that have arisen under the Wagner Act. However, it does clear away many of the features that were most objectionable to scientists, engineers and technologists.

FRANK C. WHITMORE, 1887-1947

DEAN WHITMORE'S untimely death was truly a casualty of war. During the past 8 years he carried a tremendous burden, cheerfully and willingly. His educational work was quickly geared to the demands of the Armed Forces. His war-time research touched on nearly every phase of the nation's needs. More than 30 projects, employing 150 full-time workers, contributed significantly to aviation fuels, special lubricants, super-explosives, anti-malarials, synthetic rubber, penicillin and silicones. But more than any other single member of the chemical profession, he gave wholeheartedly and unselfishly of his time and energy in trying to see that chemists, physicists and engineers were given the opportunity to work where they could do the most good in winning the war. He personally dictated thousands of letters, appeared before countless draft boards and in the end saw his position upheld and justified by the Selective Service System.

It was this prodigious effort that weakened his heart, even though it put no damper on his energy and enthusiasm. Not until the war was over was he willing to take seriously the warnings of his physician and friends. Even then he never wavered in his zest for life and for helping others.

"Rocky" Whitmore will be sorely missed by all in the chemical profession. But those of us who had the rare privilege of working with him, especially during his war-time services, realize that he has left behind a great heritage of faith in mankind and inspiration to serve our fellowmen.

GRINNELL JONES, 1884-1947

ANOTHER warm friend and counsellor to many of us was Grinnell Jones who died in Cambridge June 23. He, too, was a teacher whose classroom extended beyond the walls of Harvard. Before, during and directly after the first World War, he headed the chemical division of the United States Tariff Commission and was largely responsible for the first Census of Dyes and Coal-Tar Chemicals. His thoughtful advice and enthusiasm were of great value to that infant industry in its fight for public recognition and support. He gave stature and dignity to the calling of chemical economists, for he was one of the first to recognize the industry's need for such services and ability.

But G. Jones' great love was for Harvard—and its chemistry department. After his return from govern-

mental service he devoted his time and energy to his students, his research, his family and his many departmental duties. All who came into contact with him were benefited by his boyish enthusiasm and his frank and friendly counsel.

PRESERVING WAR CAPACITY

High officials of the Navy Department are privately confessing their great concern over the complete collapse of certain industrial capacity for making munitions. They are quietly seeking the aid of industry in preserving established capacity which might be used in the future in the event of another emergency.

Process industries should be equally concerned, even though it may not be possible for any single company to carry such capacity indefinitely at its own expense. But surely there must be ways in which cooperation between government and private enterprise can keep worthwhile units in standby condition, so long as there is any serious chance of needing them again.

Each industry, perhaps each plant, will have to be a case for individual handling. It is quite appropriate that such matters be thoughtfully studied by our industrial leaders and discussed with both Army and Navy. If some equitable basis for holding reserve capacity can be formulated, it will be in the interest of true national economy and security.

"SURPLUS" OF ENGINEERS?

Some of our educator friends are getting jittery, seemingly without justification. They are worrying about a possible surplus of engineers to be graduated some time between 1948 and 1950. We think their reasoning wholly unsound, although the arithmetic of their estimate may be excellent.

There will undoubtedly be more qualified engineering graduates coming from our colleges regularly from now on. We can be most thankful, for they are sorely needed. Not all of these graduates are going to get jobs as chief engineers or directors of research. But they can expect prompt employment by industry if they are thoroughly trained in almost any phase of engineering. Certainly, for most kinds of business a technically trained man has a running start on business employment, other things being equal.

If our educators must worry about something, we suggest they give more concern to restoring and maintaining the high standard of engineering education given by the best of our schools in pre-war days. Industrial employment officials will take the men so produced in almost unlimited numbers and pay them better than ever before in the history of industry.

"BIGGEST IN THE WORLD"

"Water is big business—on the weight and volume handled—the biggest in the world." This is the conclusion, doubtless fully justified, of one of the outstanding government geologists, Dr. N. C. Grover.

And for chemical engineers, an adequate water supply is a vital prerequisite of successful plant operation. Dr. Grover emphasizes that conventional power plants in general are similarly restricted to locations where a sufficient volume of cooling water can be had. Thus he forecasts that mine-mouth generation of power is highly unlikely in areas where water supply is limited.

These well-established principles are sometimes forgotten in the early stages of plant location. Thus it is worth while to remind ourselves that any site is bad where abundant water cannot be had cheaply.

AGE 106 YEARS

Some significant birthdays are being celebrated this summer in England. None is quite so momentuous, however, as the slightly belated centenary of The Chemical Society (of London). Founded in 1841, it is the oldest society of its kind in the world—well entitled to use in its name the definite article which Webster defines as "belonging to a particular genus or class, selected or emphatically distinguished from others of a class or group."

Celebrations originally planned for April, 1941, were postponed by the war. But this year The Society had the honor to lead a notable procession of meetings in Great Britain which included the Eleventh International Congress of Pure and Applied Chemistry and the Annual General session of the Society of Chemical Industry. To all, our congratulations and good wishes.

STILL GOING STRONG

Figures now becoming available prove conclusively that the chemical industry broke all-time production records during the first six months of 1947. Ever since the termination of war contracts, there has been an unbroken climb in output as older plants have been rehabilitated and new productive capacity has come into operation. This high rate of activity has helped somewhat to cut down the disparity between supply and demand but the widely advertized buyer's market has not yet developed among chemicals sold in largest tonnages.

A sampling of conditions in some of the principal consuming industries shows why chemicals are moving ahead faster than the curve for total industrial production. First in importance as a user of chemicals is the fertilizer industry which has had a three-fold growth in recent years. Currently operating at its peak, a further increase of 8 per cent is scheduled for the 1947-8 fertilizer year. More plant food is needed in foreign countries while here at home new markets are being opened as the industry broadens from regional to national distribution.

Paint sales this year are aimed at a billion dollars and will reach that mark unless there is a severe decline in unit prices. New construction will continue to demand both paint and glass. Long continued scarcity of oils and fats has caused a world shortage of soap but as supplies become available, output is moving ahead. The young synthetic detergent industry is mushrooming in its requirements of chemical raw materials. Rayon has shown an almost unbroken growth and now faces its biggest opportunity in tire cords. Runs to stills are setting new peacetime records, with every indication that the petroleum industry will continue to improve its position both as a consumer and as a producer of chemicals. All things considered, chemical industry can look forward to a market for capacity production for the remainder of this year and possibly well into 1948.

THE PLANT NOTEBOOK

Theodore R. Olive, ASSOCIATE EDITOR

$50 CASH PRIZE FOR A GOOD IDEA!

Until further notice the editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. The winner each month will be announced in the issue of the next month: e.g., the August winner will be announced in September and his article published in October. Judges will be the editors of *Chemical Engineering*. Non-winning articles submitted for this contest will be published if acceptable, in that case being paid for at applicable space rates.

Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Neither finished drawings nor polished writing are necessary, since only appropriateness, novelty and usefulness of the ideas presented are considered.

Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.

JULY WINNER

A $50 prize will be issued to

G. E. HADDELAND
Deep River, Ont., Canada

For an article describing an ingenious design of liquid piston pump for HCl or other corrosive materials that has been judged the winner of our July contest.

This article will appear in our September issue. Watch for it!

June Contest Prize Winner

HOW A SERIES OF FIXED, ACCURATE PRESSURES CAN BE MAINTAINED ON A PROCESSING SYSTEM

WALTER R. SWENSON
Assistant Chief Draftsman
The Dorr Co., New York, N. Y.

A PROBLEM encountered during the design of the Dorrco de-ionization system for the Hawaiian Pineapple Co.'s new plant at Honolulu was that of changing pressures in the de-ionization cells automatically, and maintaining such pressures within close limits. A method of solving this problem is illustrated in the accompanying sketch. It should have other applications.

In operating the cells in this de-ionization system, it is necessary to hold the solution height at a set level within each of the pressure vessels. The desired solution level is maintained and controlled by a valve on the discharge side of each cell, which is in turn regulated by a float within the cell. Through a connection as shown, air pressure is built up within the vessel sufficient to overcome the head under which the liquid is being passed through the exchanger cell. However, these operating pressures are subject to variation; during a complete cycle the pressure in the cation cell must be changed five times, using three different pressures. The manner of accomplishing this is described as follows, in conjunction with the drawing:

Pressure reducing valves A are of the type wherein the main valve is operated by a pilot nozzle, and also include an automatic bleed.

Solenoid valves *B* are normally closed, two-way valves.

Valve *C* is a reverse-acting diaphragm valve. The downstream pressure is direct connected in the valve, to the underside of the diaphragm.

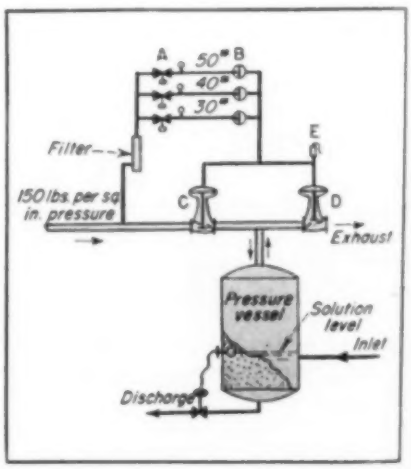
Valve *D* is a direct-acting diaphragm valve. The upstream pressure is direct connected in the valve to the underside of diaphragm.

Valve *E* is a safety valve set slightly higher than maximum operating pressure within the vessel.

Solenoid valve *B* can be energized either manually through a remote switch, or automatically through a pair of contacts in a control instrument.

Let us assume the pressure in the vessel at 0 psi. ga., at that part of the cycle requiring 50 psi. pressure to pass the liquid through the cell. The solenoid valve in the 50-psi. line is energized. This introduces 50 psi. pressure on top of the diaphragm in valve *C*, opening it, and 50 psi. pressure on top of the diaphragm in valve *D*, closing it. When the pressure in the vessel reaches 50 psi. plus, valve *C* closes. The differential pressure in the vessel, between introducing pressure and exhausting, can be held to a matter of ounces by preloading the diaphragms with weights.

Let us assume now that the solenoid in the 50-psi. pressure line is de-energized and the solenoid in the 30-psi.



How diaphragm valves and controlled air pressure are used to maintain several fixed system pressures

pressure line is energized. The trapped pressure in the line at the top of the diaphragms will exhaust through the automatic bleed in the 30-psi. pressure regulator. Valve C now having 50 psi. pressure on the bottom of the diaphragm and 30 psi. on the top will open, exhausting pressure in the vessel. When the pressure in the vessel falls to 30 psi. minus, valve *D* will close.

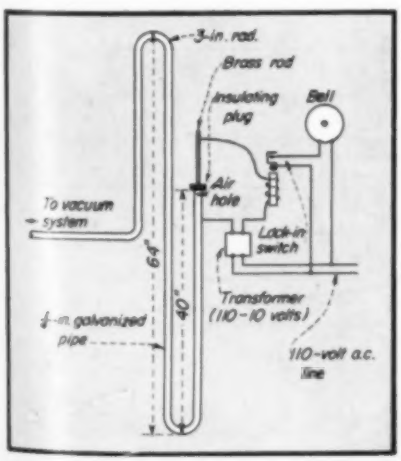
If any gases are liberated during the process, tending to increase the pressure within the vessel, they are exhausted through valve *D*.

DEPENDABLE TYPE OF VACUUM ALARM

PAUL C. ZIEMKE
Oak Ridge, Tenn.

OPERATORS of cyanide precipitation processes employing the Merrill-Crowe process strive energetically to maintain as near perfect a vacuum as conditions permit. A sustained vacuum means low precipitant costs and the end result is also noticeably free from zinc. Under such conditions an alarm is inaluable in maintaining the closely adjusted system where barren solutions of minimum gold content are expected.

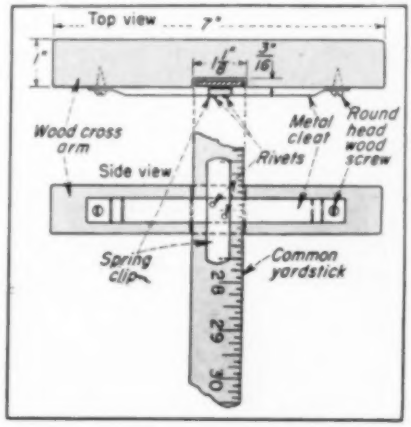
An alarm serves to keep the operator informed of any mishaps to the system which may cause as little as a 2-in. drop in vacuum. This may occur through stoppage of the vacuum pump on account of mechanical defect or power failure, leaks in the system, or sticking of sensitive butterfly valves. In operation the U-tube shown in the sketch is filled with mercury which fluctuates in level as the vacuum in the right leg of the device varies in value. A corresponding movement, of course, takes place in the left leg.



Mercury serves both as manometer liquid and electric contact in this simple vacuum alarm and signalling system

The length of this section is arranged so that no overflow of mercury can occur when the whole system is returned to atmospheric pressure during shut-downs. The insulating cap is machine turned from hard fiber and a ⅛-in. hole is provided to insert the brass rod which forms contact with the mercury as it rises. A step-down transformer is inserted in the 110-volt circuit to reduce the accidental shock hazard to a minimum, although the bell itself remains in the 110-volt circuit. Closing the 10-volt contact closes a magnetic switch which locks in and maintains its contact after once being made. It is then tripped out manually once the operator's attention has been called to correct an abnormal condition.

The brass rod is inserted in the fiber plug by a press fit which makes possible adjustments to meet any desired vacuum values, or atmospheric pressure. The bends in the ¼-in. pipe are made best by bending with an electrician's conduit bender. In fact our plant electrician performed all the work.



Outage measuring device which practically eliminates reading errors

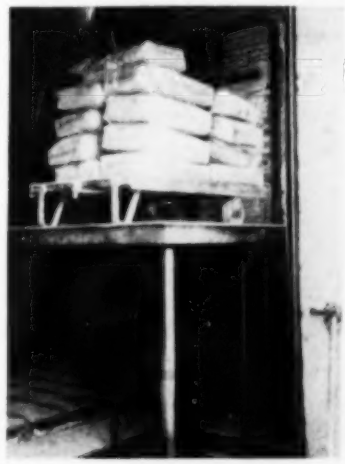
ADAPTING YARDSTICK TO OUTAGE MEASUREMENT

ALBERT W. STEIN
Schering Pharmaceutical Corp.
Bloomfield, N. J.

A MEASURING stick made from a common yardstick, sketched herewith, was the outcome of the need for a device which would make outage readings uniform among a number of chemical operators. Since the volume in numerous crocks was figured from calibration charts upon which titration results depended for the strength of the liquids contained therein, this device made it possible to obtain more accurate measurements for the chemist to use in controlling chemical reactions. Formerly, operators might err as much as a quarter of an inch if they did not take readings at eye level.

Retains Measurement

In use, this measuring device is inserted into crock or other vessel, with the wood cross-arm resting on the rim or lip of the container. The yardstick is then merely pushed down until it just reaches the surface of the liquid. Upon removal from the container, the tension of the spring clip holds the yardstick snugly while the operator determines the exact measurement. Provided this cross-arm is not disturbed, the operator or chemist can refer back to the measurement on the yardstick, if need be, and not try to recall it from memory as by the old method.



This hoist for chemicals in bags was built largely of scrap materials

HOME-MADE HOIST SPEEDS HANDLING OF CHEMICALS

HANDLING of chemicals unloaded from freight cars at the treatment plant of the Atlanta, Ga., waterworks, has been expedited through the construction of the air-hoist shown here. Built mostly of scrap materials under the general direction of Paul Weir, assistant general manager of the Atlanta water department, the power of the hoist is supplied by compressed air pressure applied to oil which in turn exerts pressure on a 10-in. dia. piston with a maximum travel of 72 in.

Two 1½-in. dia. guide pipes attached to the platform and operating in steel sleeves embedded in the foundation slab keep the platform in proper alignment. The hoist is used both in car unloading and in transferring bags of chemicals from storage to trucks.

FIELD-ERECTED TANKS

(Continued from page 101)

ferent locations; (2) both standard API tanks with no allowance for corrosion, and chemical tanks with ⅛-in. corrosion allowance have been included.

The estimator should know the location and the amount of corrosion allowance required, if any, and apply his judgment to determine where a given tank should be in the spread of the curve.

If the desired tank is far different from the standard dimensions mentioned above (namely, square dimensions) or if it is to store liquids of high specific gravity, Fig. 2 will not apply and the tank should be sufficiently designed to calculate its weight directly and the cost then estimated from Fig. 1.

In Fig. 4 tank costs for alloy and clad steels, prepared from the curves and data above, were grouped since considerable overlapping occurred. Again, all minimum and all maximum costs were combined to obtain the upper and lower limits of each curve. No corrosion allowance was used as these materials will normally be used because of their corrosion resistant properties. Factors causing the spread in these curves are as follows: (1) Erection rates at different locations; (2) materials costs; (3) fabrication and erection costs. The estimator should weigh these factors when using the curves in Fig. 4.

Aluminum tanks have been excluded in this discussion because the physical properties of aluminum are so different from the materials discussed that no satisfactory way has yet been found to tie the cost of aluminum tanks into the basic curve of Fig. 1. However, after aluminum tanks have been designed and the weight determined, the cost may be estimated from the following for open territory:

15 to 18,000 gal. = $2.00 per lb.

50,000 gal. = $1.50 to $1.60 per lb.

100,000 gal. = $1.25 per lb.

Erection will be about 40 percent of the total cost.

Determining Costs of Tanks, Spheres and Drums

R. A. DICKSON
Chemical Engineer, Caldwell, N. J.

PROCESS EQUIPMENT COSTS

BELOW I should like to present a formula for obtaining the first cost of tanks, spheres and drums of a required size when the cost of another size is known.

This formula, $c = a \times b^{0.8} \times x^{0.7}$, is as simple to use as a vitamin pill and it has as many uses in the industrial metabolism, where comparison of costs between various sizes of tanks, spheres and drums is involved. The terms are defined as c = cost of the container; a = cost per unit (barrel, cubic foot, gallon, etc.); b = capacity of this standard size, in the units selected; and x = capacity of the container whose cost is desired, in the units selected.

How It Works

For example, if the cost of an 85,000-bbl. (120 × 42 ft.) tank, complete with all accessories and painted, is known to be $86,700, then the cost per barrel is $1.02. If it is desired to know the cost of a 1,250-bbl. tank, which is only 20 × 24 ft., use of the formula gives:

$$c = a \times b^{0.8} \times x^{0.7}$$
$$= 1.02 \times 85{,}000^{0.8} \times 1{,}250^{0.7}$$
$$= \log 1.02 + 0.3 \log 85{,}000 + 0.7 \log 1{,}250$$
$$\log c = 3.64666$$
$$\log^{-1} c = \$4{,}433$$

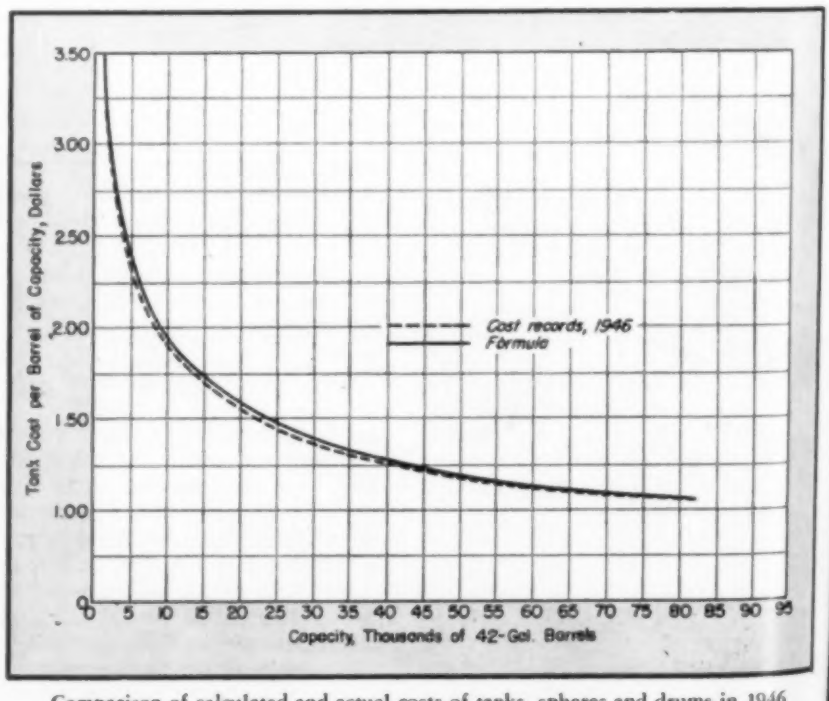
This formula works both ways: given the cost of a big tank it permits one to find the cost of a little one; on the other hand, given the cost of a small tank, the cost of larger tank can also be found.

The thickness of shell and head of drums under pressure varies so widely with diameter, as well as pressure, that the use of the formula is limited to drums of the same diameter and internal pressure. For pressure spheres the limitation is that only spheres for the same internal pressure can be compared.

Periodic Revision Needed

If work with tank, sphere and drum prices extends over a period of years it is necessary to get new values for a in order to keep the formula in line with cost changes.

Close agreement between actual tank costs in 1946, and costs calculated by the formula, is shown by the accompanying curve.



Comparison of calculated and actual costs of tanks, spheres and drums in 1946

REPORT ON . . . . .

Management's Role in PLANNING RESEARCH

DAVID B. HERTZ

Assistant Chief Development Engineer, Celanese Corp. of America, New York, N. Y.

Research has become a billion dollar industry in the United States—the fastest growing and potentially the most important factor in our postwar economy. To make it most productive in profits as well as in human and social progress is a No. 1 objective of American industry. On the shoulders of top management rests the heavy responsibility not only for providing funds and facilities but, more importantly for seeing that they are used most efficiently. In this report are cited some of the more important problems involved in setting up a proper research program and planning for its profitable performance. All who have a part in advancing research and translating its results into productive plants and process will be benefited by this thoughtful study of management's problems and responsibilities.

THE PLANNING of industrial research is one of the most difficult problems which faces top management in American industry today. It can easily be by-passed and left to chance. The cost of improper planning may not be readily apparent in the profit and loss statements, but the losses involved can be very large. The penalties of improper planning and the returns from proper planning can be graphically illustrated by an actual research project.

One of America's largest companies was faced with a continuing problem of fabrication which represented a large proportion of its costs. The problem seemed simple. It comprised a straightforward metallurgical process. The company management had authorized research on the problem for the past 20 years, and after spending $2 million felt that there was little more to be learned about the process.

During the war, priority allocation of materials changed the components which could be used. This seemed to present no problem since the backlog of research work on the process pointed quickly to a satisfactory substitute. The use of this substitute required higher process temperatures and, therefore, research into the improvement of other product components to withstand these higher temperatures. This was done without hesitation and the entire situation seemed settled. At this point a study of available ternary diagrams indicated that with a very small amount of the material controlled by WPB, temperatures used could again be reduced. Application for this amount of material was made and approved. Use was made of the new composition, and eventually it was discovered that the use of a slightly greater amount of this material in the alloy would entirely eliminate the high cost substitute material.

The new result was satisfactory from the standpoint of use and temperature; the only drawback was the fact that the amount of the first material was critical and this was overcome. Thus, after a long trial and error process, which included considerable additional cost over and above the original $2 million, the management of the company discovered that for many years they had been using an alloy much richer in the scarcer and more expensive element than necessary.

This would certainly indicate that something was lacking in the original research program. Planning seemed to be present, since the company was willing to pay for continuous research for a period of 20 years. But when a

test came, the research seemed to have been a failure. The fault did not lie with the research facilities nor with the decision of management to carry out a long term project, but with the lack of a broad plan of attack.

It appears that the alloy finally used was at the extreme end of the range, and at some time it had been decided to limit research to the medium alloy content range because it was the general "opinion" that this was the only profitable field for research. It is true that the alloy finally decided upon was somewhat more critical in the matter of its use, and that certain control factors had to be carefully determined and maintained. However, if this alloy had been used for only ¼ of the 20 years spent in research, at least ½ of the amount spent during the entire period would have been saved in material costs alone.

Problem in Planning

This example is not intended to illustrate the vagaries of research results which are inevitable, but merely to point out that the top management of any enterprise is faced with a serious *problem in planning* when a decision is made to expend funds on a research program. It is much simpler to plan properly for new plants, new machines, sales promotions, etc., than to choose a satisfactory research program.

The basic questions are: first, how much shall be expended and second, what projects shall be chosen? It would seem foolish in the solution of the first problem to set an arbitrary sum which, being arbitrary, might be too much (*waste*) or too little (*lack of results*). In actual practice this factor is closely connected with the choice of the areas of attack of the research program. Whatever the amount appropriated, this latter choice can determine the success or failure of the entire expenditure.

This paper will attempt to analyze the planning involved in the choice of a research program from the standpoint of producing profitable results. These profitable results or general objectives have been variously defined:

"An industry should turn to research when it wishes to accomplish one or more of the following things:

1. Anticipate and prevent troubles
2. Cure existing troubles or nuisances
3. Reduce the cost of a product
4. Increase the utility of a product through modification or simply by finding new uses
5. Reduce the consumer's operating or maintenance cost

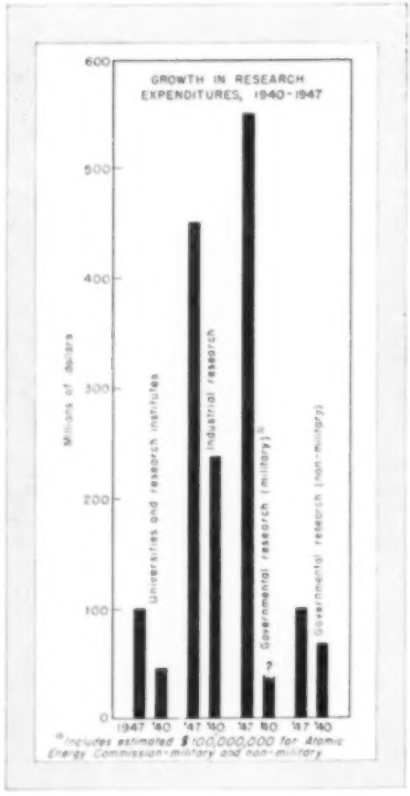


Fig. 1—Research is now a billion dollar industry. During World War II, the government expanded its research budget from $67,000,000 in 1940 to $720,000,000 in 1944. This year governmental and private expenditures will be about $1,200,000,000 as compared with $345,000,000 in 1940

6. Develop new process material or products
7. Improve the quality of existing materials or products
8. Bring about better standardization
9. Amass technical information leading to a better understanding of a product
10. Contribute to the common store of general knowledge with the ultimate motive of increased markets through raised standards of living".[1]

"Research is potentially capable of yielding results which may fall under one of five heads. These are:

a. New products
b. Use of new products evolved by others in improving upon or economizing in the production of the same article
c. Refinements in machinery
d. Refinements in processes".[2]

It is clear that these definitions of the objectives of research fall into two general categories which should eventually reflect in the profits of an enterprise.

1. Increased sales of old products or sales of new products
2. Decreased production costs

The problem shall be approached from the standpoint that any enterprise can afford to spend a certain amount for research work, which amount should be expended in accordance with a distribution plan broadly laid down by top management in such a manner as will result in the maximum return from the expenditure. The first part of this analysis will attempt to discover a method of choosing the amount to be expended. The matter of establishing the distribution plan will constitute the second part of the analysis. In this connection it has been said that: "The choice of the research project is more important than the manner of its subsequent prosecution."[3]

Research Expenditure Planning

Expenditures for research work are increasing in industry year by year. Appropriations of manufacturing corporations for research increased from $116 million in 1930 to $240 million in 1940 and probably close to $500 million in 1947. Government research has risen from $24 million in 1930 to over 20 times that amount today. In 1920 there were 265 industrial research laboratories and in 1940 there were 2,350.[4]

In other words, industrial research is coming of age. In a list of America's 100 largest industrial corporations there is not one which does not maintain a research staff and laboratory. The figures for the increase in the number of independent research laboratories and institutions probably have followed the same trend as indicated for private industry. This trend should make it clear that industry is beginning to find that research is not only profitable, but essential for continuing stability. Research is dynamic and under the technological conditions which exist today, few enterprises can either conquer new markets or reduce costs without a staff of competent research technologists.

The gross national income in 1946 has been estimated at approximately $185 billion,[5] and if we assume overall research expenditures are approximately 1 billion, then research expenditures are roughly one-half of one percent of the gross national product. Taking into consideration only manufactured products, it would appear that 1 to 2 percent of gross income is a fair average for research expenditures of manufacturing enterprises as a whole.

Budgeting for an over-all research expenditure in an individual enterprise is often mysterious and confusing. How much shall be spent? The answer may be 1, 2 or 3 percent of gross sales, ½ of 1 percent of net profits, 6 percent of manufacturing labor costs or what have you. Or, "We want a specific new development and we will spend what it takes to get it." Or, "Our research has profited us by an average of a certain amount in the past and we will spend half that average each year."

Firms reporting research activities to the National Resources Planning Board spend annually an average of 2 percent of their gross sales for research. In many cases, it is obviously a recognition that something should be spent and then a decision as to how much can be afforded. This is probably a simple approach, but for a given firm what factors should influence choice of the amount which can be afforded?

An attempt shall be made to analyze various methods of establishing a research appropriation and set up various reasons for choosing what is believed to be a logical approach. The general methods used may be broken down as follows:

1. Budgetary basis—Percentage of sales or other figures
2. Potential returns basis (or average of past returns)
3. Competition basis

Budgetary Basis

The first of the above methods of allocating funds for research is ostensibly the simplest for top management. It is easy to say that a research budget will be 2 percent of gross annual sales. But why not choose 1 percent, 3 percent or 10 percent?

Research expenditures have been compared to advertising expenses in that the money must be expended in advance of returns. However, advertising budgets are set up because a certain expenditure is necessary to maintain or increase sales in the face of competition, sales resistance or the public's ignorance of the product. A given firm will not ordinarily anticipate gross sales without a decision as to advertising and promotional expenses.[6] These will be determined by anticipated results—not necessarily because it appears wise to spend a given percentage of sales for advertising.

This particular method has little to recommend it since it requires no actual planning. It may be of value for the firm whose research is not intended to accomplish specific results with product or process, but merely to serve as technical advice to management. In such a case, expenditures of more than 1 percent of gross sales are probably not warranted.

Typical Estimates for Research

Project	Expended 1946	Probable Costs 1947	1948	Returns 1946	Estimated Returns* 1947	1948
1 (New Product)	$6,000	0	0	$15,000	$25,000	$25,000
2 (New Product)	0	3,000	0	0	4,000	10,000
3 (New Product)	0	5,000	5,000	0	0	25,000
4 (Process Improv.)	2,500	0	0	4,000	8,000	8,000
5 (Process Improv.)	0	3,500	1,000	0	0	12,000
6 (New Machine)	3,000	5,000	0	0	7,000	14,000
7 (Misc. Investigations)	2,000	2,000	2,000	0	0	0
8 (Process Improv.)	2,000	0	0	0	0	0
9 (New Machine)	1,000	0	0	4,000	6,000	8,000
10 (New Product)	2,000	0	0	0	0	0
TOTALS	$18,500	$18,500	$8,000	$23,000	$50,000	$102,000

*Profits on Sales & Cost Savings

Ten projects – total costs – 1946, 1947, 1948 = $45,000

Total returns (actual & estimated) – 1946, 1947, 1948 = $175,000

Budget check – estimated expenditure (3 years) = actual returns (1946) plus ratio of estimated returns. $45,000 = $23,000 plus .145 × $152,000

Table I—Data like these form basis for setting up research appropriations

Potential Returns Basis

A more logical approach to the problem would be in the choice of an appropriation on the basis of probable cost and potential profits and/or savings. "A research appropriation is an investment and subject to the same laws of probability that govern any investment."[7]

One would not set up an investment fund of any amount without some guess as to the probable return. Research appropriations should be considered from the standpoint of the projects to be undertaken and their possible results. The amount to be expended should be determined from these facts.

That not all projects can yield a successful return is obvious. In a carefully considered program perhaps one out of ten projects will be profitably successful, and the successful project must carry the less fortunate ones. Choice of projects cannot logically be separated from estimates. Proper planning of the projects is an integral part of setting up a research appropriation, but for the time being we shall assume that the projects have been logically chosen.

Table I gives a simple illustration of the type of estimate we would recommend as a basis for setting a research appropriation. The figures might be representative for an enterprise with a gross annual sales volume of $1 million per year. They should not be considered as being indicative of the absolute number of projects or amounts to be spent for each, but merely illustrative. Such an estimate should be set up on a multi-yearly basis since results of research cannot usually be realized in the year a given project is begun. The period chosen may vary from one year to five (or even ten in special cases). The choice of this period will largely depend on the type of projects and the general or average period of their fruition. For example, in the chemical industry many years will elapse before a new product can be translated into production, while in the mass production industries a new machine may be in use and producing a saving in a matter of months. The choice of the period can best be made upon careful examination of the research program.

It is always best to consider at least one past year in making up an estimate of this type in order to observe actual results along with anticipated figures. Having chosen the time interval for the estimate, each project should have estimated costs and savings carefully tabulated. Note that we have considered four types of projects:

1. New products
2. New machines
3. Process improvement

4. Miscellaneous investigations

For the last, no tangible savings can usually be shown, but the research appropriation should provide for carrying these as a service to management. Estimated returns should be on the basis of estimated profits, on the sale of new products and on cost savings. The probable cost for the future period plus actual cost for the past period will equal actual returns plus a ratio of estimated returns.

For example, in Table I the ratio is:

Ratio = (Actual cost + Estimated costs − Actual returns)/ Estimated returns

or, ($18,500 + $26,500 − $23,000)/$152,000 = 0.145

This ratio might be called the estimated success ratio. In other words, in setting up this appropriation, if 14.5 percent of the estimated returns are realized, the investment in research will have paid its overhead, miscellaneous costs and investigations, costs of all other investigations, *and broken even*. The ratio will, of course, vary from enterprise to enterprise and from year to year, but, on the whole, a figure between 0.10 and 0.20 may be considered safe.

If the firm progresses with research work, experience will enable top management to define this percentage with a great degree of accuracy. It will be seen that on the basis of this type of estimate, a large return in any one year will enable greater estimates to be made for the future. This is a logical consequence of dynamic research work.

An appropriation can be set up on the basis of average past returns but, in general, this is not a sound or logical procedure since projects should vary from year to year and anticipated work will either be deluged with funds or suffer as a consequence. We feel it is better to combine some portion of actual past savings with estimated costs and estimated future results. Of course, if the estimated costs appear too high for the working capital of the firm to carry in a given year, it is possible for top management to eliminate as many projects as necessary to bring the budget into line. This is a sound procedure since the choice will usually be made on the basis of those projects which have the best chance of success, and other projects may be deferred until they can be adequately handled.

Competition Basis

The third method of arriving at a figure for an appropriation for research work has no basis in logic but may be required by force of circumstances. This is what we have chosen to call the competition method:

It may sometimes be forced upon an enterprise by trends in an industry —trends which are forcing prices and sales down and in which competitive products are taking over the market. Here lower costs, better quality or even new products may be called for and, in this case, there is no choice but to resort to research.

The amount to be spent will be dictated by the limits of resources of the given firm, and in any event, "The biggest gamble is no research at all."[a]

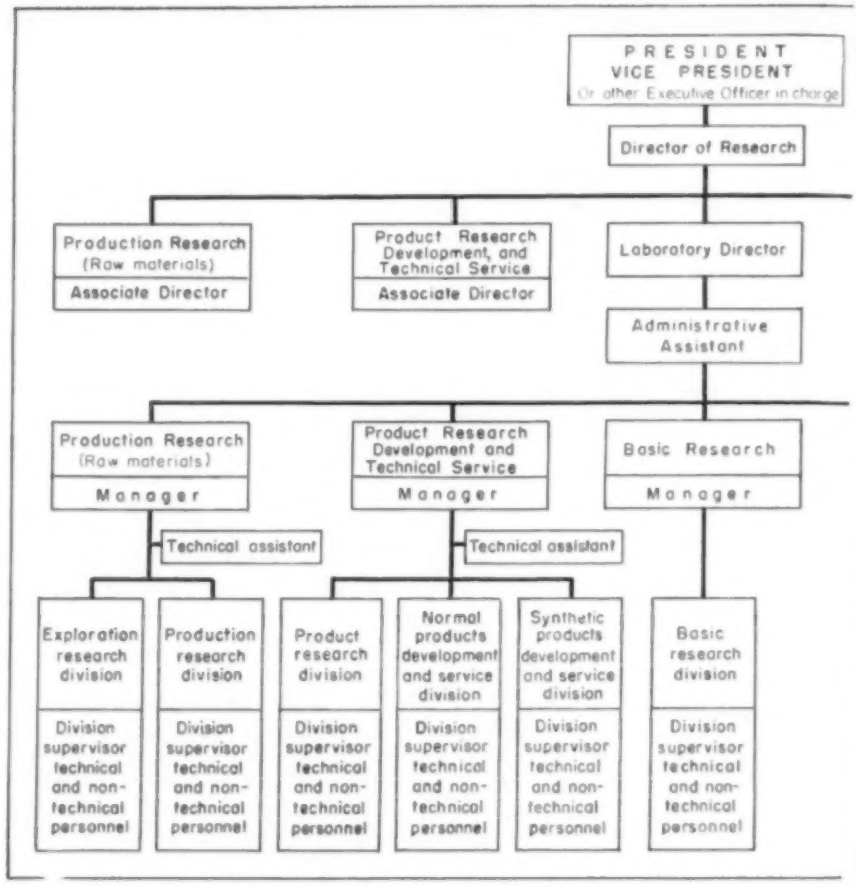


Fig. 2—How industrial research activities may be organized as a company division, department or separate subsidiary. This chart, accompanied by explanatory matter in the form of management or functional guides, appears in a recent

Program Areas and Projects

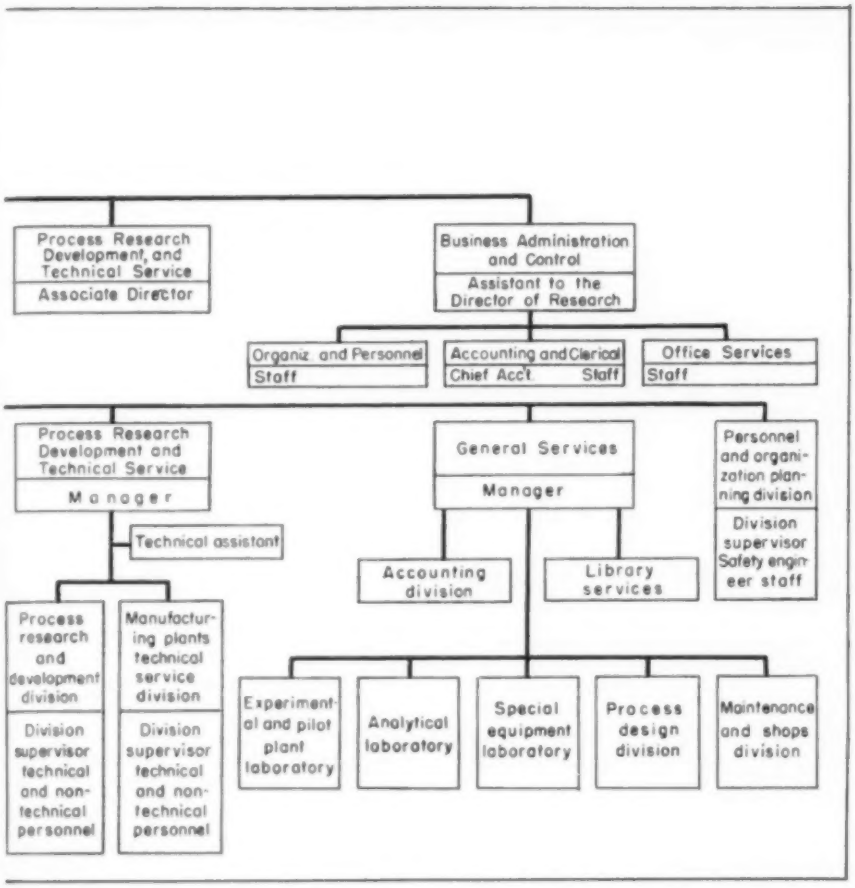
Before projects can be chosen, a decision must be made by top management as to the specific areas which research shall attack. In the small firm this decision may limit the research program to one phase of the company's activity. In the large enterprise, on the other hand, it probably will represent a choice of the relative emphasis to be placed on particular phases. The general areas of attack for industrial research may be delineated according to type, to wit:

1. Over-all process areas
2. Intra-process areas
3. New method or new product areas

In order to plan a profitable research program, each of the above should be carefully considered. In general, the cost of research for developing new methods or products will be the most expensive but will have the best chances for high returns if successful. Chances of success in developing new methods and processes are somewhat less than chances of improving old products, processes or process components. Over-all process investigation is probably more expensive than intra-process investigation, but will probably offer larger returns on the research investment.

Over-all Process Areas

This phase of a research program can be defined as an investigation into the improvement of an individual process as a whole, or an investigation into the interrelationships of the various manufacturing processes carried on by the enterprise with a view to improvement and integration of prod-



booklet "The Co-ordination of Motive, Men and Money in Industrial Research" prepared by Darrell H. Voorhies, copyrighted and published by the Standard Oil Co. of Calif. and its subsidiary, California Research Corp., of San Francisco

ucts, production methods, quality or marketing factors (and this last may be taken to include service to customers in the form of technical data), process use aids or other information demanded by the particular industry.

Over-all process research is often a fertile field for profitable work and may be considered as the internal area for maintaining a dynamic manufacturing structure. Cost reductions made through this type of improvement can be substantial. Therefore, price and sales trends within the industry are important considerations in deciding whether or not large percentages of the research budget be devoted to this type of work. If the price trend is definitely downward or if the sales of a particular product are declining, it is natural to anticipate that it will be the desire of top management to reduce the costs of manufacture. A research program pointed in this direction should then be considered.

The patent trends in the industry would also have a bearing on over-all process research. If process patents are expiring or if competitive firms are patenting new and improved processes, then research projects should be undertaken to provide improved methods for the particular enterprise.

Product improvement is a part of this phase of the research program, but new products are not included in this particular category. Price, sales and quality trends will play a definite part in the decision to prosecute projects aimed at improving a product. In most cases, either the over-all process itself or the product will be susceptible to improvement.

The choice of the particular process or product to be investigated should come as a result of a preliminary investigation. It will be noted that approximately 10 percent of the typical estimate shown in Table I is set aside for miscellaneous investigations. Preliminary examinations of products and processes would fall into this classification.

The purpose of the preliminary investigation will be to determine the feasibility of research work on the particular processes or products, the potential results of this work and the probable cost. From a report on such an investigation, top management can plan to include or eliminate this particular phase of research activity or any parts of this phase from the yearly estimates. We cannot be too emphatic in stating that no large scale projects in this area should be undertaken without preliminary examination and careful appraisal.

In choosing specific processes or products for these preliminary investigations, many ideas will undoubtedly filter to top management from sales, production, engineering and research echelons below. If these sources do not provide sufficient material, there are two facts concerning all of the company's processes and products which are readily available to top management and on the basis of which choices may be made. These are:

1. Age of each process or product
2. Cost of each process as it relates to the final product manufactured cost

It should be apparent that the older processes and products probably offer the best opportunities for improvement, and that the more costly portion of the entire manufacturing process will offer best opportunities for returns from improvements.

The first step in the planning of a program in this area will be the choice by top management of particular products or processes for preliminary investigation. Estimates of probable costs or returns are not necessary for this preliminary investigation. Having received this preliminary report, management should then be in a position to determine the advisability of including a particular project in the program.

Intra-Process Areas

Intra-process areas include research on specific components of a given process or product, such as the development of an improved processing machine or improvements in one particular component of the final product. Here the choice of a project is at least as important, if not more important, than for over-all process areas since it is quite possible to expend a great deal of effort on a specific component of a process with only minor savings, when the same amount of effort might be able to improve or change the entire process with major results.

The selection of intra-process projects for presentation to top management is best done by the Production Department, which will probably be in the best position to determine potential results and possible savings. A preliminary investigation is not necessarily called for in such work, but prior to its presentation to top

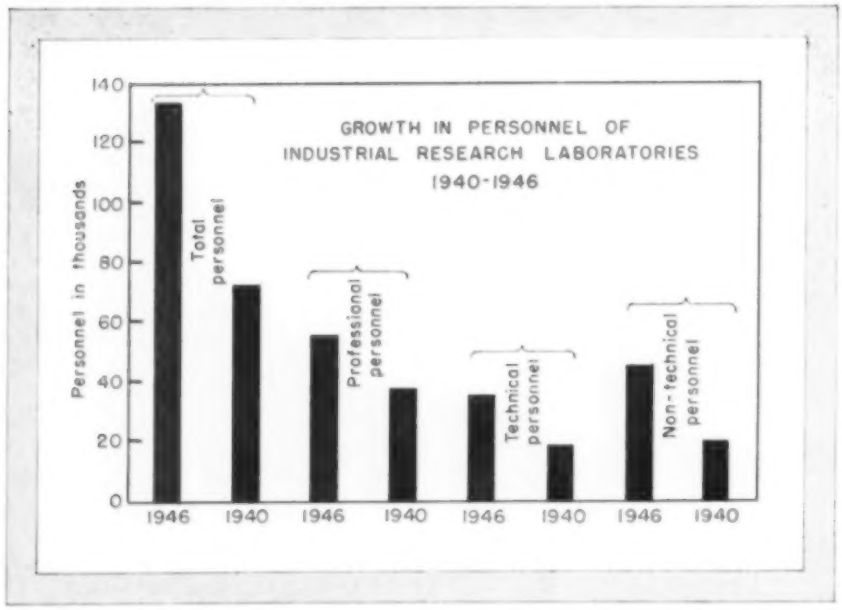


Fig. 3—Professionally trained personnel predominates in industrial research laboratories surveyed by National Research Council

management the project should be outlined in a joint conference between the research department and the production department. This is advisable since such a project should be presented in detail as to costs and probable savings. Also, some projects can be filtered from the requests for appropriation by such conferences. This will lessen the task of top management in planning over-all research work.

It is entirely possible that some proposals for research on process components will originate with the research department on the basis of new materials and new ideas which may be more readily available to them than to production. In general, it may be said that these projects do not render substantial returns over their costs. It should be noted here that what we have chosen to call a process may in one industry be a process component. This does not change the general outline of planning, but is merely a matter of definition in each particular enterprise.

New Methods or Products

The production of new methods or new products is the field in which truly spectacular returns may be obtained on the research investment. New methods and new products should include development of new end uses for products which require much research work in some industries. Work in this area will definitely influence the growth curve of a particular enterprise. Sound expansion can often be based on the results of research work leading to new methods and products. There is no best source for new ideas, but we have observed that they have a remarkable tendency to emanate from the group just below top management. In any case, all new ideas should filter through top management since the final choice and estimate of potential results can best be made by them.

It is up to the research department to furnish estimates and costs of the development of new ideas. These estimates, particularly in the early stages of a project, are extremely difficult to predict. Choice of projects falling under the area of new ideas should be determined on the basis of:

1. Probable costs vs. possible results
2. Trends in the industry
3. Trends in the individual enterprise

Probable cost is difficult to determine, but an estimate is best made on the basis of breaking the particular new idea down into:

1. Preliminary investigation to determine feasibility
2. Having determined the idea to be feasible, further investigations to determine probable time and cost involved
3. Further work leading to completion of the project

Determination of possible results is well within the field of top management planning. Obviously, top management is best qualified to decide whether or not a new process or product will offer either expanded sales or sufficient cost savings to warrant research investigation.

Trends in the industry should enter into the choice of a research program leading to the development of a new product or process, and trends in the individual enterprise, while often overlooked, should be taken into consideration. If the enterprise is relatively stable and if the growth has been approaching a static condition, choice of research leading into something new might appear desirable. On the other hand, if the enterprise has been expanding rapidly and the production of a new product or installation of a new process might represent a serious drain on working capital, it is possible that research work along these lines should be deferred.

Time Element

In the above discussions on the choice of expenditures and projects for research, we have not mentioned planning from the standpoint of time. It is obvious that proper planning of either expenditures or projects cannot be divorced from the time element. Since the time involved from the start of a project to its fruition will influence both the amount to be expended and the areas of research attack, it should be carefully considered when a program is evolved.

If the projects to be considered are broken down into short, medium and long range projects, top management will be in a better position to determine the advisability of entering into specific commitments. Short range projects may be those which will be completed in six months to one year, medium range from one to two years and long range—over two years. These differences will vary from enterprise to enterprise depending on the particular industry.

When the estimated appropriation is made up and projects are chosen, an indication of time categories will enable top management to make intelligent plans. It would not usually be proper to spread a low cost, low return project over a number of years since it is possible that when such a project is finished the need might have disappeared. The same consideration of the long range need for the results of the particular research will also apply to medium and long range projects but in a lesser degree. It would also be improper to attempt to compress a truly long range project into a short time interval since this might lead to inadequate or unsuccessful results.

The choice of the time interval on

each project is obviously up to top management since the degree of concentration of research activity on various projects will depend on this choice. There is a serious danger of mischoice, and when the time interval is to be decided upon, careful planning is required. In conjunction with the choice of the time interval, the priority to be given to the various projects should be determined.

Specific Project Planning

When it has been decided to proceed with various projects for research and an appropriation has been made, there remains the planning of each individual project. Fundamentally, this is not a problem for top management, but lies within the scope of the research department itself. However, each project should be completely planned from start to finish and the over-all concept of the planning involved should be established by top management.

Each phase of this plan should follow a definite and pre-determined order. The research worker is not to be handicapped by a pattern of research from above, but the over-all planning should be such that each project will traverse definite stages of work, and at each stage reports should be made to top management in order that further planning can properly be carried out. The decision as to these stages and reports should be made by the planning group. Patterns for process or product improvement projects will generally follow a different plan from the patterns for new products or processes.

At various stages in any project, alternative paths of attack will be presented. If these alternative paths represent major deviations from the original plan, the decision as to which alternative shall be followed must be made by top management.

Process, Product or Machine

A preliminary investigation is the first and essential step in this type of work. If the project falls definitely within the over-all process area, then a more or less elaborate report on the preliminary investigation should be presented. The investigation and report should cover:

1. The feasibility of accomplishing results
2. The estimated costs and savings or potential returns

The particular type of project and the particular industry will be the determining factors in setting a pattern for this preliminary investigation. It should be kept as short as is consistent with sound research. Reports on this type of work should be as definite as possible under the circumstances involved in each particular project.

There should be no difficulty in arriving at fairly accurate and satisfactory figures for costs and returns. Costs may be based largely on previous experience, and estimated returns should be available either from the objectives of the particular research if it is a process improvement, or potential additional sales if it is a product improvement. Having presented top management with this report, the next step in the pattern might be to carry on such experimental work as is necessary.

The preliminary investigation should only have indicated feasibility, but this stage of experimental work should give a definite picture of the results to be obtained. This may be the most expensive part of the project since it may involve a pilot plant, prototype model or actual production of samples of improved material. When this phase is complete, there should be no doubt as to whether or not the project can be pushed to a successful conclusion. This is the point in the successful planning of research work at which a decision can be made on the basis of rather reliable facts as to whether or not further expenditures are warranted.

In the proper planning of any research work it is equally important to know when to stop or when to make a decision allocating additional funds. The head of research should be able to furnish top management with a definite recommendation at this stage, and the final decision should not require too much effort. The next stage should be the estimation of final costs for production management and the estimation of completion dates.

The remaining stages in the project are material planning, construction and installation.

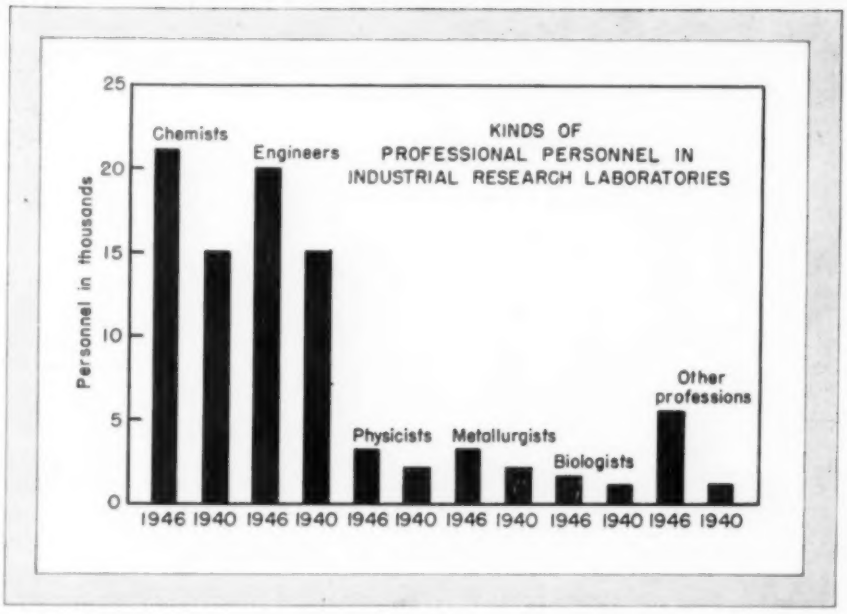


Fig. 4—Chemists and engineers account for 80 percent of the professional personnel according to N.R.C. Bulletin 113 of July 1946

New Processes or Products

In planning a pattern for new processes or new products research work, a preliminary investigation of the type described above is not required. The decision to proceed with experimental work should be made by top management and, once made, the work should continue until definite indications of probable results are obtained. The time allowed for this work should be adequate, and the research department probably should not be pressed for results so long as top management feels that the project is worthwhile. As soon as definite indications of the probable results are obtained, top management should be informed and decisions concerning further work made. This may be the point in the investigation at which an estimate of probable costs and of further work can be made and furnished for the purpose of fitting the over-all costs into the research appropriation.

The decision about future work should be made by top management,

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but the recommendations of the research department can play a strong role in arriving at this decision. However, it may happen that the research department recommends the project be dropped on the basis of experimental results, whereas top management may wish to continue because of their knowledge of potential returns.

At some point it must be decided to make prototype equipment or carry on pilot plant work for the project. Management should be able to make this decision on the basis of accurate cost estimates furnished by research. Having constructed prototype or pilot plant equipment, the results of research work with this equipment should be reported along with estimated costs of full scale operation.

Research work basically will end with the decision to proceed or discontinue the project at this stage. Production designs may in some cases be required of the research group, in which case, their interest in the project will naturally continue.

Conclusions

The setting up of a research program is basically a problem of top management planning in any industrial enterprise. The carrying out of research itself should rest in the hands of a competent director of research. Decisions which will be required fall into four categories:

1. Setting up an appropriation for research
2. Decisions as to the areas in which research shall be carried on and the specific projects in the program
3. Decisions as to the time to be allowed to the various projects
4. Planning of a research pattern for the various types of projects

It has been recommended that appropriations be set up for research on the basis of careful estimates of probable costs and returns. We have indicated that there is a ratio called the "probable success" ratio which may be used as a measure of the soundness of the research appropriation. We have also discussed other methods of arriving at amounts to be expended for research and have found that they cannot properly be applied on the basis of sound planning.

The choice of projects has been discussed from the standpoint of various areas of research which are: over-all process, intra-process and new methods or products.

Over-all process research has many advantages over intra-process research in the utility of the results for promoting dynamic growth of a healthy organization. New methods or products offer fertile fields for substantial returns, but are more hazardous and more costly than the other types of research. Planning from the standpoint of time is an important part of the work of top management in setting up a sound research program and will result in the proper concentration of research efforts in accordance with their desires.

To insure the success of a research program, proper planning of research work is as important as, if not more important, than the actual research work itself. We repeat R. P. Soule's statement that "The biggest possible industrial gamble is to do no research at all."

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Facts About Research*

The broad facts about industrial research are as follows:

1. *Applied research is clean competition.* Developing new things to appeal to customers is a cleaner, more constructive type of human effort than trying to beat down labor rates and freight rates, or to secure a corner on available raw material.

2. *The competitive edge which an enterprise gains by successful industrial research is a temporary one.* Generally, research results are published freely. Only the temporary monopoly occasionally granted by a patent gives protection to the funds invested.

3. *Industrial research broadens the base of living.* It brings out new things.

4. *No one knows what will eventuate as the result of an industrial research program.* We know that the byproduct results of research are frequently more important commercially than the main stream of effort.

5. *Industrial research done in one industry frequently provides the basis for building a new industry.*

6. *Industrial research done in one industry almost invariably helps other industries.*

7. *Most new industries start out as very small businesses.* Any idea that research is necessarily the handmaiden only of great enterprise is incorrect.

8. *It is not necessary for a business, large or small, to have a research laboratory in order to benefit from research.* Consulting laboratories, research institutes, and trade association laboratories all play their parts in advancing technology.

9. *The individual inventor still makes important inventions.* All do not spring from industrial laboratories, large or small. The frozen food idea came from Clarence Birdseye, a biologist. Polaroid glass was invented by Edwin H. Land while a university student.

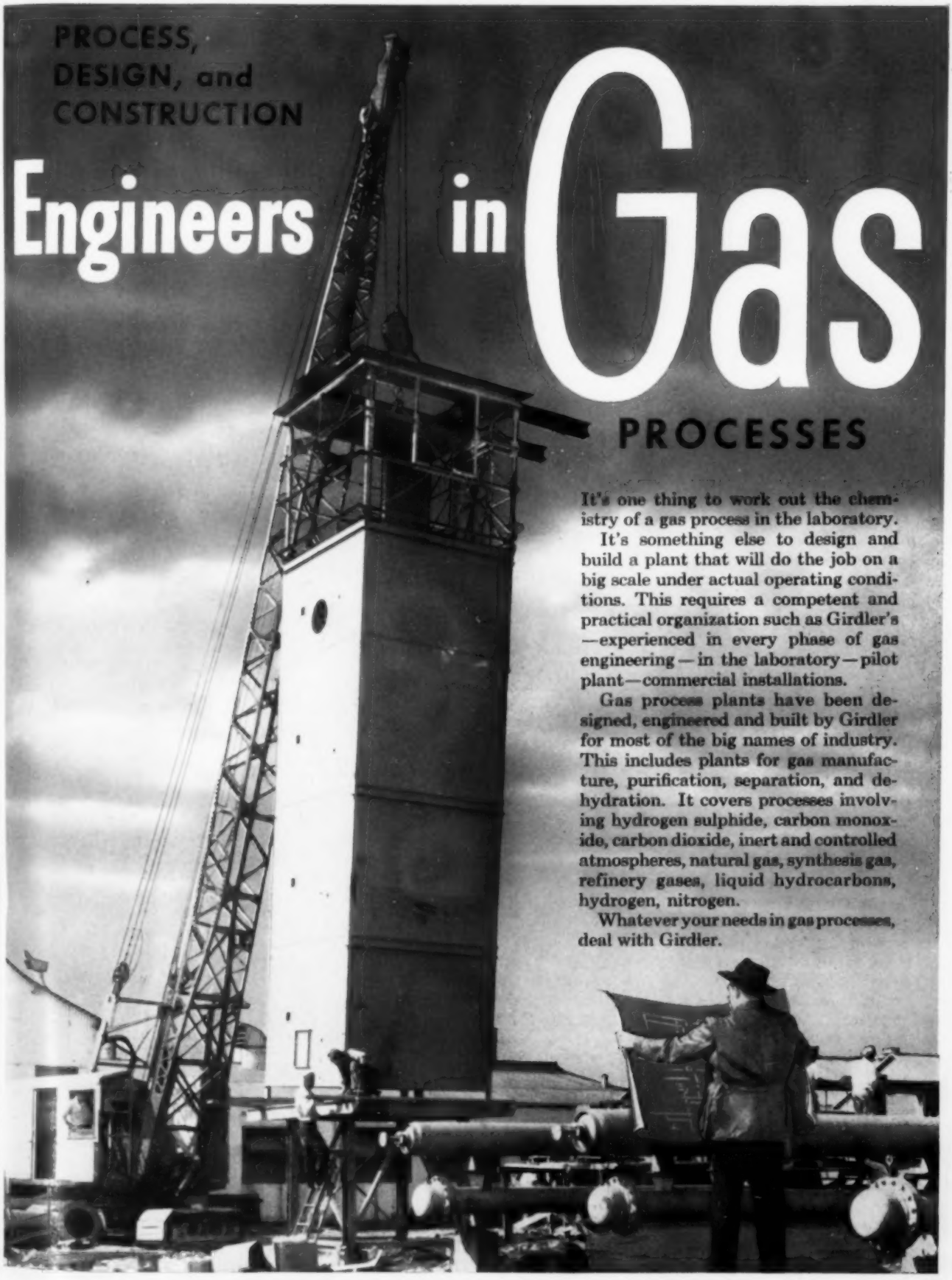
10. *In arguing against the granting of full life-sized patents to men working in large laboratories, the alleged reformers are arguing merely against granting patents.* Some of the critics of the patent system and, indirectly, of technological efforts by private industry, sneer at the ownership of patents by corporations. They quote the phrase "to reward the inventor" and then add that, under the corporate system, the inventor-employee seldom gets any reward and that the employer takes it all. To offset this, we must say that the only reward that the patent system ever did hold out was one to the individual manufacturer under which, for a time, he could utilize his patented invention without competition.

11. *The various schemes usually advanced to correct the alleged economic evils of granting patents are schemes that would hurt little businesses which the proponents of these schemes pretend to want to protect.*

*From a paper by Bruce K. Brown, Vice President, Standard Oil Co. (Ind.) Chicago, Ill.; presented before the Industrial Research Institute, Inc., February 27, 1947, at Edgewater Beach Hotel, Chicago.

PROCESS, DESIGN, and CONSTRUCTION

Engineers in Gas PROCESSES



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MAGNESIUM CHEMICALS

PIONEER commercial producer of magnesium salts from sea water is Marine Magnesium Products Corp., whose plant at South San Francisco has been in operation since 1928 producing magnesium carbonates, oxides and hydroxides. The firm also designed and perfected a great deal of the special equipment and machinery which has made the operation of this process so satisfactory. The company is now developing several new magnesia products.

Unlike processess for producing metallic magnesium from sea water raw material, the Marine process requires considerable purification in the initial precipitation of the magnesium hydroxide. Sea water containing chlorine gas and dead organic matter is treated with a small amount of milk of lime in a special mixing tank equipped with flocculating paddles. The flocs of $Mg(OH)_2$ holding particles of $CaCO_3$, silica, iron and organic matter are removed from the bottom of a 750,000 gal. settling tank. The 99.998 percent clear effluent goes through a gravity sand filter into a 1,250,000 gal. precipitation tank where more milk of lime is added. Here the $Mg(OH)_2$ concentration is increased from 0.5 percent at the top to 12 percent at the bottom of the tank. This slurry, containing 88 percent sea water with 3 percent salt, is sent through Monel plates having 5,000 holes at the top of two washing towers in series. Fresh water is introduced into the center of the washers. Concentrate from the bottom of the second tower contains 10 percent $Mg(OH)_2$ with 0.05 percent salt.

Part of this concentrate goes to carbonating kettles and is treated with CO_2 from boiler flue gas. It is then treated with steam, vacuum filtered and dried in a special tunnel dryer to produce dry basic magnesium carbonate. By elimination of CO_2 and water vapor, U.S.P. or rubber-grade light MgO is produced.

Another part of the 10 percent $Mg(OH)_2$ slurry is treated and diluted with steam and passed through a Monel vacuum filter, which increases the solids contents from 7 percent to 30 percent. This "Hydro Magma" paste is packaged in 525-lb. galvanized iron containers. By injecting water into this paste and spray drying, dry $Mg(OH)_2$ powder is produced. By heating this power to 1,000-2,000 deg. F., U.S.P. heavy MgO is manufactured. U.S.P. milk of magnesia, containing 8 percent $Mg(OH)_2$ and 92 percent water, is made by screening and diluting part of the 10 percent $Mg(OH)_2$ concentrates from the washing towers.

CHEMICAL ENGINEERING

August, 1947

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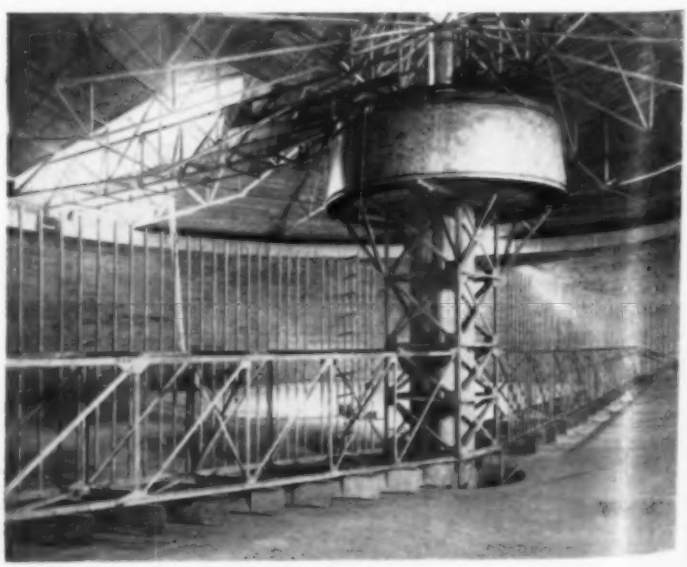
General view of Marine Magnesium Products Corp. plant at South San Francisco

1 Sea water containing chlorine and organic matter is treated with milk of lime in flocculating tank and settled

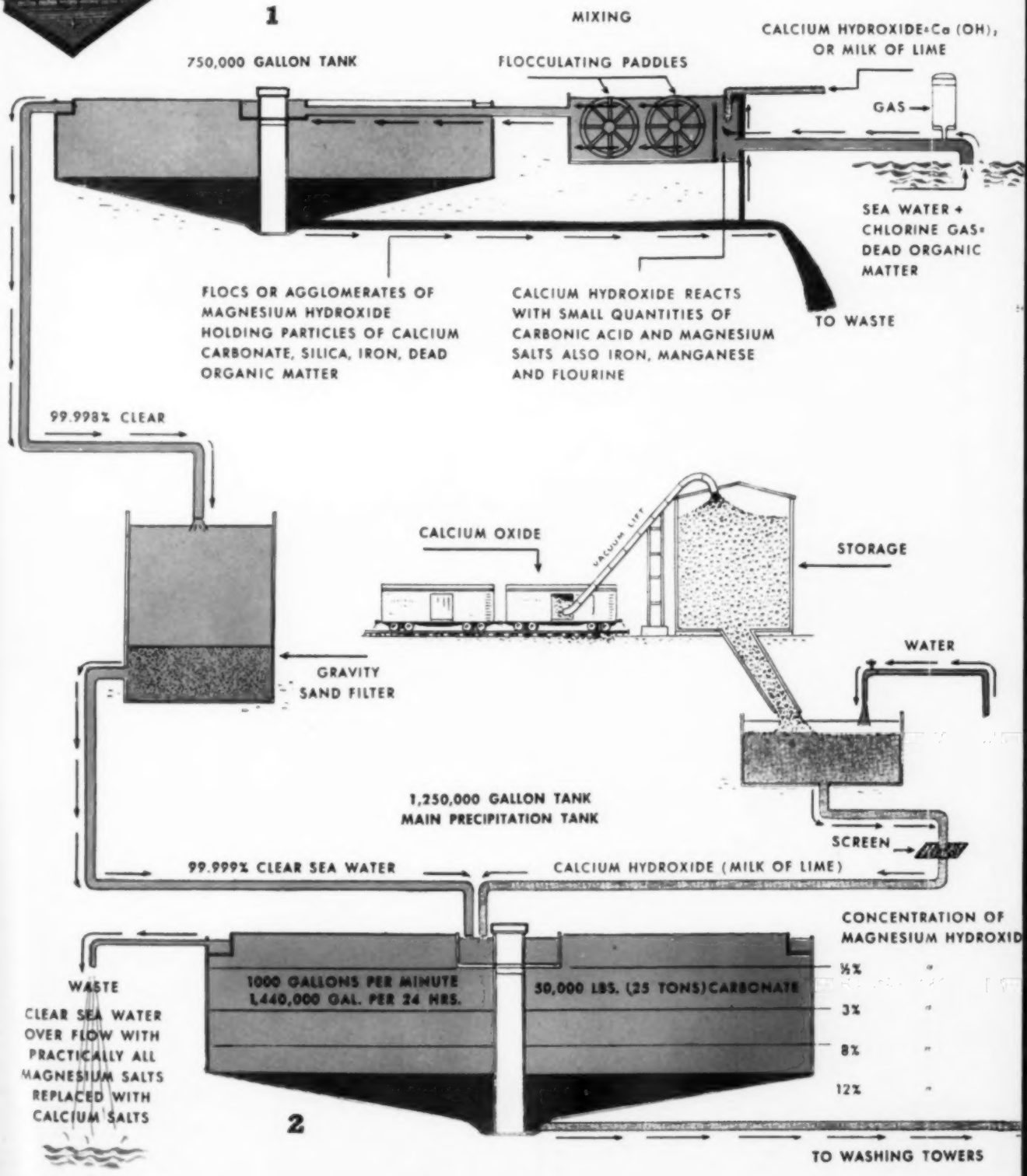


2 After filtering water goes to precipitation tank where milk of lime is added and $Mg(OH)_2$ concentration increased

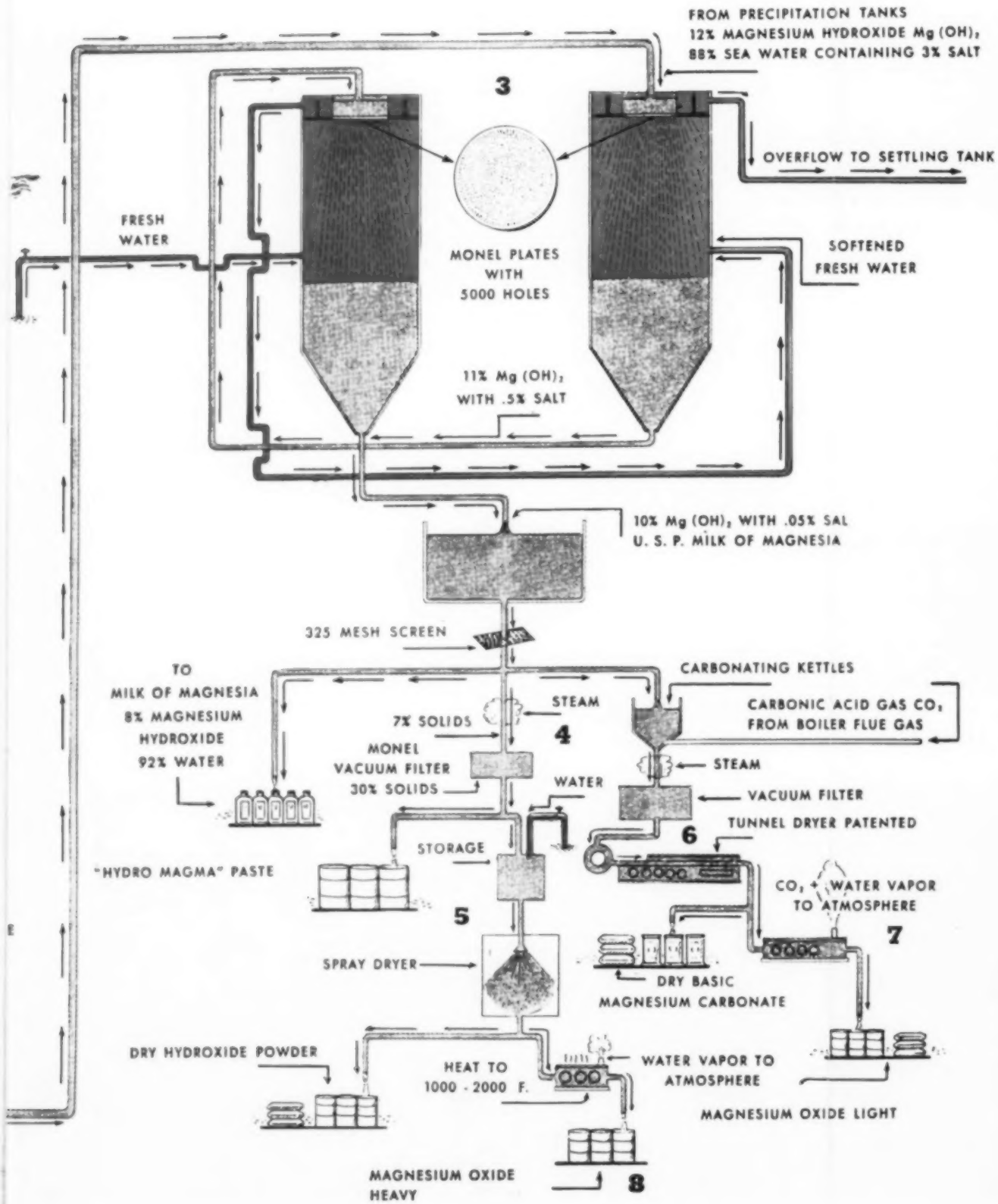
"Chem & Met"

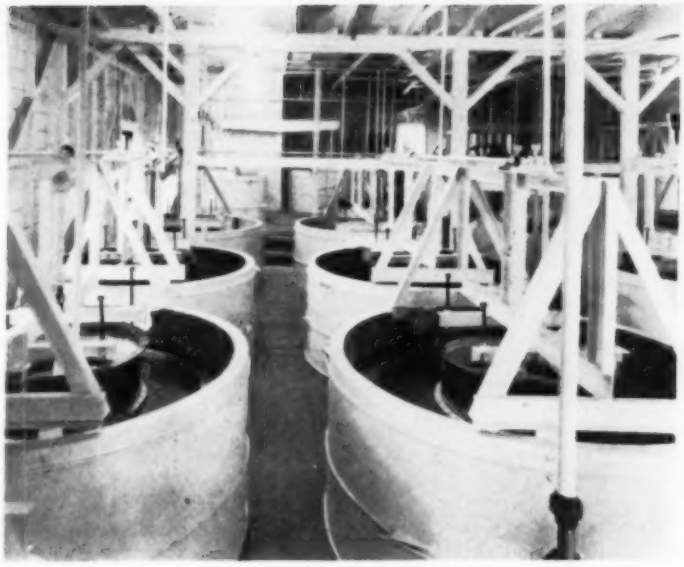
PICTURED FLOWSHEET

PRELIMINARY PURIFICATION PROCESS



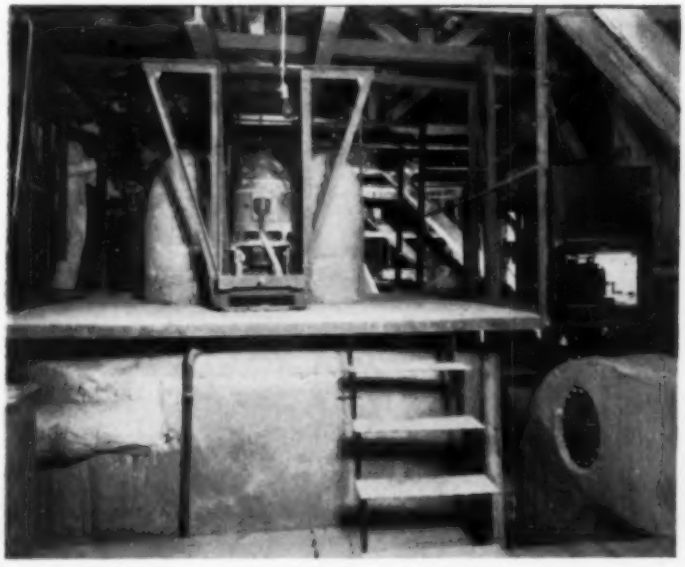
PURIFICATION OF
PRECIPITATED MAGNESIUM HYDROXIDE $Mg(OH)_2$



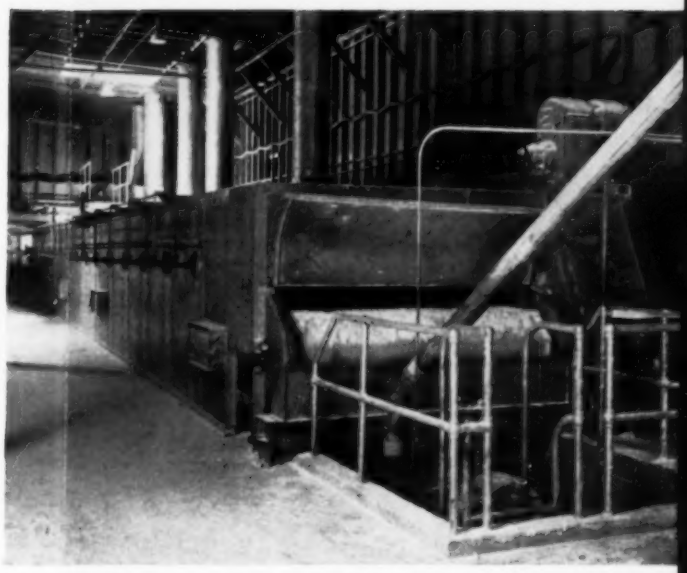


3 $Mg(OH)_2$ slurry is sent to two washing towers in series. Part of this concentrate goes to carbonating kettles

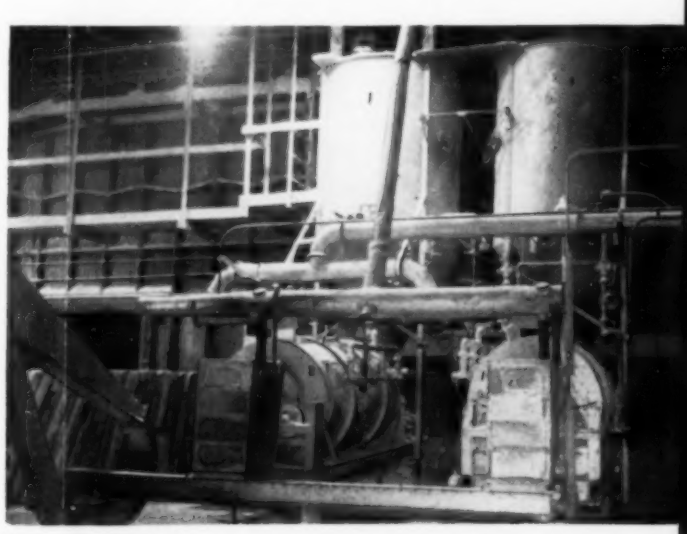
4 Part of slurry is treated, diluted with steam, passed through Monel vacuum filter and packaged



5 By injecting water into this paste and spray drying, $Mg(OH)_2$ powder is produced



6 Part of slurry is treated, filtered and dried in tunnel dryer to produce dry basic magnesium carbonate

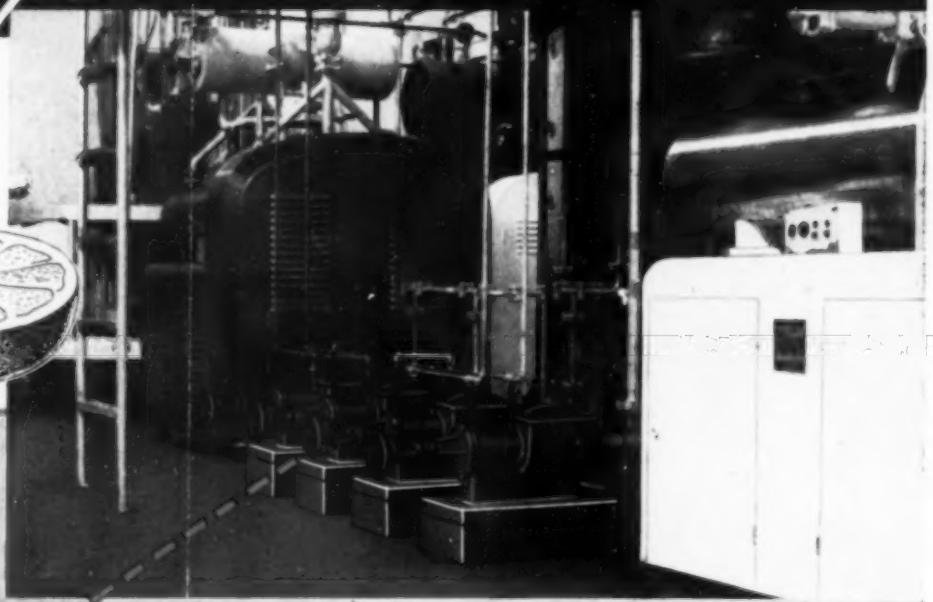


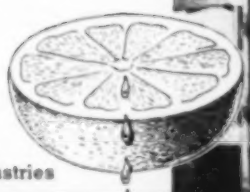
7 By eliminating CO_2 and water vapor in these kilns U.S.P. or rubber-grade light MgO is produced

8 By heating dry $Mg(OH)_2$ powder to 1,000-2,000 deg. F., U.S.P. heavy MgO is produced

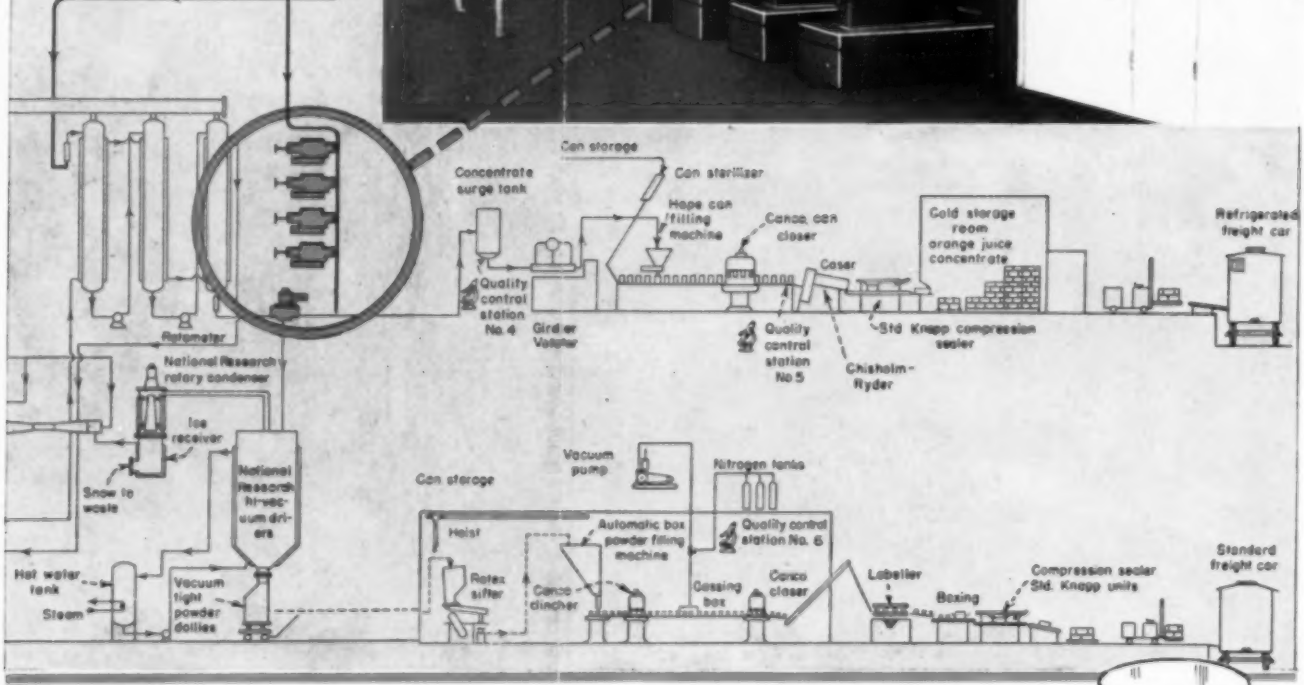
Adding Flavor TO A NEW PROCESS

%PROPORTIONEERS% installation engineered for Vacuum Foods Corp., Plymouth, Florida, by National Research Corporation, Boston, Mass.





Flow sheet, courtesy Food Industries



In this successful streamline process, %Proportioneers% Treet-O-Units add fresh orange juice, in exact proportion to the flow of orange concentrate, to maintain the original fresh flavor and to add pulp to the product. The process is continuous, automatic and completely flexible: Without interrupting production, adjustments can be made to compensate for slightest variations in the flavor of the raw material. Here, as in the production of many other timely products, %Proportioneers% method of streamline processing eliminates guesswork, assures accurate proportioning, protects investments in materials and controls the quality of the end product.

Ask for Bulletin 1200 and reprint of Food Industries article describing this process.

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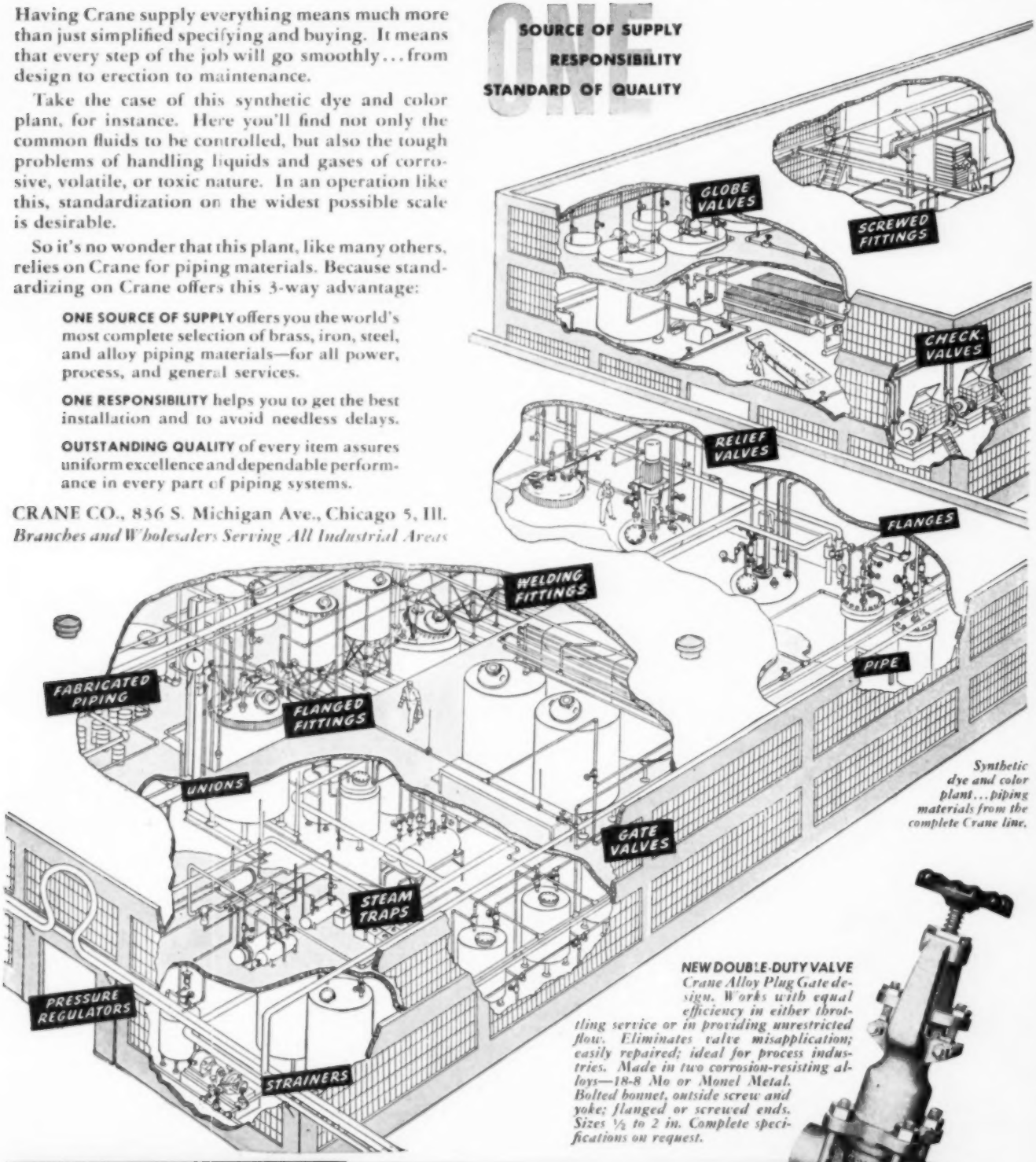

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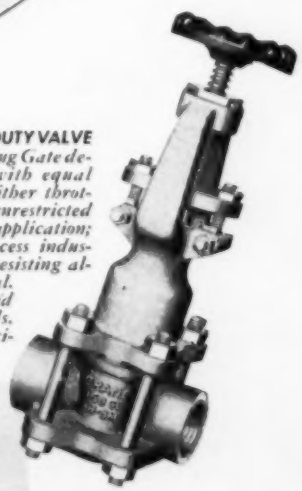

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PROCESS EQUIPMENT NEWS

Theodore R. Olive, ASSOCIATE EDITOR

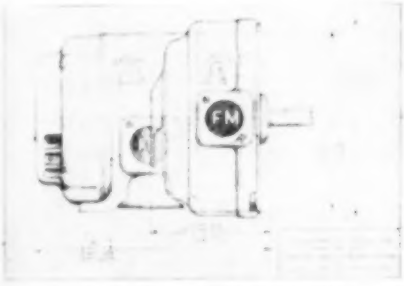

Fig. 1—Dimension-weight comparison for axial air-gap and conventional motors

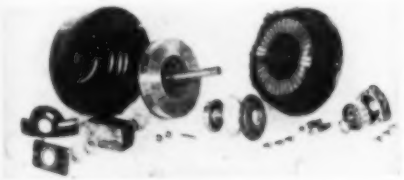

Fig. 2—Disassembled view of Type QZAK axial air-gap motor

1. Axial Air-Gap Motor

A RADICAL DEPARTURE in electric motor design has been developed by Fairbanks, Morse & Co., 600 South Michigan Ave., Chicago 5, Ill., in its new axial air-gap electric motor. This motor, now produced in sizes from ¼ to 10 hp., has as its outstanding feature space and weight saving. In general, the length of one of these new motors is about one-half that of a comparable conventional type motor (and its diameter 1 to 2 in. larger) while its weight is about 30 percent less. Motors of this type are particularly suited for flange mounting in either horizontal or vertical position, the same motor being used for both mountings with a change only in the cover.

Fig. 1 shows superimposed drawings of a conventional motor and an axial air-gap motor and gives corresponding dimensions and net weights for the two types. Fig. 2 shows a disassembled view of the new motor, making clear how its pancake rotor and stator elements are constructed. It will be evident that the magnetic lines of force follow a path parallel to the axis of rotation, as compared to the radial path in conventional motors.

The motor is extremely simple in construction and can be inspected, cleaned and lubricated with particular ease. It is said to be easier to cool than conventional motors and, having less overhang, to be particularly suitable for direct mounting on machinery of many kinds. Since it has about three times the flywheel effect of motors with small diameter rotors, it should not be used for applications involving repeated plugging and reversing. Conversely, where the flywheel effect is necessary to overcome periodic peak electrical loads, the new construction is particularly desirable. Efficiency of the new motor is said to be comparable to conventional types except that friction and windage losses may be slightly higher owing to the larger rotor and the necessity for a thrust bearing to overcome magnetic pull between the rotor and stator. Operating characteristics and speed-torque characteristics are comparable in practically all respects to conventional motors. The new motor is not intended to supersede or displace conventional types in general industrial applications, except in those cases where its use is a definite advantage owing to space or weight saving or ease of mounting.

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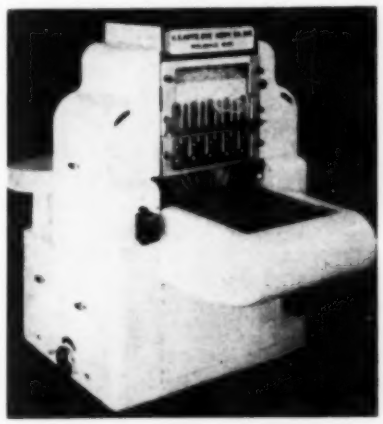
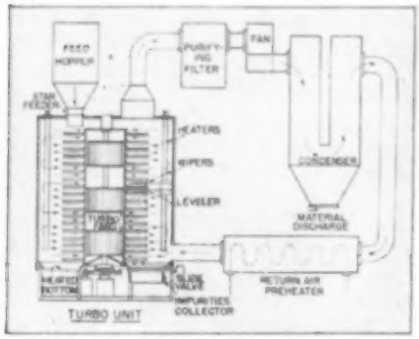


Automatic signalling and recording check-weigher

2. Electronic Check Weigher

TO MAKE POSSIBLE large savings through elimination of overweight in package filling, the Fred Goat Co., 314 Dean St., Brooklyn 17, N. Y., has introduced the Weightrol, an electronic check-weighing machine which check weighs every package passing through it on a conveyor and indicates whenever the filling machine is filling above or below the limit of its inherent filling error. At the same time the Weightrol automatically ejects underweight packages from the line. However, ejection is selective and in case of the packaging of expensive materials, the machine can be set to eject both overweight and underweight packages. The machine is equipped with signalling lights, designed to warn operating personnel located anywhere on the packaging

floor whenever a filling machine needs checking or adjusting. The machine also gives an indication as to the type of adjustment needed to bring the filling machine back into control. In addition to its indicating feature, the machine makes a continuous chart record of filling machine performance, with recorders located, if desired, in the plant superintendent's office.



Continuous closed circuit subliming unit

3. Turbo Subliming Unit

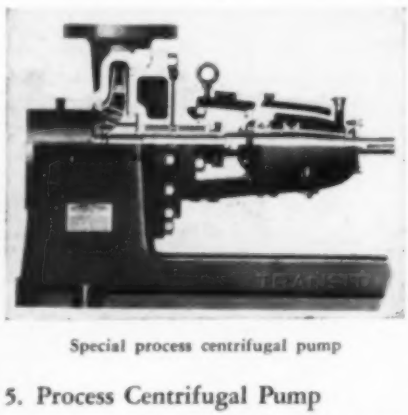
EMPLOYING a modification of its Turbo dryer, the Wyssmont Co., 31-04 Northern Boulevard, Long Island City 1, N. Y., has introduced a continuous subliming unit using recirculated air to achieve maximum heat and product economy. As the accompanying illustration shows, the Turbo unit proper consists of a vertical series of rotating shelves, or trays, for the material, with heating units situated outside the shelves and circulating fans mounted on a vertical shaft located concentric with the stack of shelves in such a manner as to recirculate air continuously over the shelves and heating units. Material is fed continuously through a feed hopper at the top, while impurities which do not sublime are collected at the bottom for periodic removal without interrupting operation.

As material is fed an adjustable spreader levels it off to a thin, pre-set thickness on each individual tray. After the material has remained undisturbed for one revolution, the material is wiped off through gaps between the trays and falls on to the next lower shelf where it is again levelled off on each tray as before. This transfer of material is repeated until the material has completely sublimed and only the impurities remain to be removed through the bottom slide valve. Owing to the fact that the unit is completely inclosed, it is well adapted to employment of a closed circuit in which the air is returned from the condenser to be used over and over again. As compared with a batch process, savings in space and power as well as higher efficiency are claimed.

A unit of the same type can be employed readily for the removal of solvents and their recovery, particularly where gases other than air must be used as the vapor carrier to eliminate explosion hazards or to prevent decomposition which might occur in the presence of air.

4. Glass Electric Heaters

METALLIC conductors of various suitable metals, completely embedded in Pyrex glass or silica glass, are used in constructing a new line of electric immersion heaters produced by Thermolector Products, 95 Broad St., New York 4, N. Y. Because the wire is in intimate contact with the glass over its entire surface, the heat transfer is said to be excellent. In water the heat output of the unit is equivalent to 125 watts per square inch and yet the temperature of the wire is low as long as the heat can be carried away as rapidly as produced. The units can also be provided armored with a heavy metal coating, the space between the unit and the armor tubing being filled with lead or other suitable metal. Where especially high resistance to heat shock, corrosion or high temperatures is required, silica glass units are used. The units are produced for 600 watts at 120 volts, and 1,200 watts at 240 volts. Larger or smaller units are available on special order. The 600-watt unit has a ½-in. nominal diameter with an immersed portion 4 in. long, while the 1,200-watt unit has a ¼-in. nominal diameter with the immersed portion 7 in. long.



Special process centrifugal pump

5. Process Centrifugal Pump

ALL CAPACITIES from 40 to 1,500 g.p.m., for differential heads from 40 to 1,000 ft., are available in a line of special process centrifugal pumps introduced by National Transit Pump & Machine Co., Oil City, Pa. Produced in both cast iron and steel, the pumps are suitable for operating pressures to 600 psi. at 100 deg. F. and 500 psi. at 450 deg. F. for the cast-iron type; and to 1,000 psi. at 100 deg. F. and 500 psi at 800 deg. F. for the steel type. Speeds range from 1,750 to 4,000 r.p.m. Features of the design provide for extremely high temperatures or pressures, the handling of hot or cold liquids and liquids near the boiling point, and the production of extremely high suction pressures. Stuffing box design is such as to reduce leakage around the shaft to a minimum. The pump is of the side-suction type with double-bearing support for the shaft and overhung rotor.

Air velocity meter

6. Air Velocity Meter

AIR VELOCITIES as low as 5 ft. per minute can be measured accurately, it is claimed, with a new ultra-sensitive air velocity meter introduced by the Hastings Instrument Co., P. O. Box 1275, Hampton, Va. Suitable for measurement of velocities in ducts, and air and gas lines, as well as wind velocity and the determination of movement in surveys of heating and air conditioning systems, the instrument is based on a new combination of the hot wire and thermopile principles. The pick-up element is a noble-metal thermopile which is placed in the air stream. Alternate junctions are arranged to have much greater cooling than the adjacent junctions which are heated by passing alternating current through the wire. The temperature rise of the warmer junctions is measured by the d.c. voltage that is thus generated. Standard range of the instrument is from zero to 2,000 ft. per minute.

7. Silica Removal Unit

APPLICATION of the principles of demineralization to the removal of silica from raw water intended for boiler feed has been made in equipment now being offered by the Liquid

PFAUDLER GLASS STOPS CORROSION.. *starts the reaction right!*

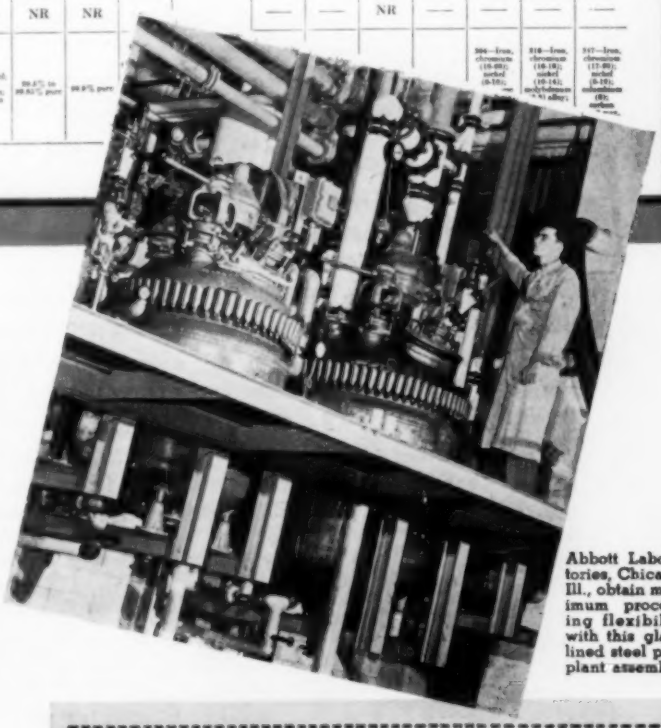
TABLE No. 1—RESISTIVITIES

TYPICAL SERVICE CONDITIONS		% by Wt.	PH Value	PFAUDLER GLASS LININGS 42	24	48	27	OTHER MATERIALS Nickel	Monel	Inconel	Aluminum	Copper	Durichlor	Hastelloy A, B, C, & D	Karbate No. 2	Havog	Lead	Rubber	304 Stainless	316 Stainless	347 Stainless
	Hydrochloric Acid	Conc. 35.0% 22° Be.	—	R*	R*	NR	NR	NR	NR	NR	NR	NR	R†	A group of nickel- molybdenum -iron alloys in varying composition which provide remarkable resistance to hydrochloric acid, wet chlorine, sulfuric, phosphoric and other acids; ideal for accessories in difficult service; see page 9.	R*	R	NR	—	NR	NR	NR
	Hydrochloric Acid	N 3.38%	0.1	R*	R*	NR	NR	R	R	NR	NR	NR	R†		R*	R	NR	R	NR	NR	NR
	Hydrochloric Acid	N/10 0.36%	1.0	R*	R*	NR	NR	R	R	R	NR	NR	R†		R*	R	NR	R	NR	NR	NR
	Hydrochloric Acid	N/100 0.036%	2.0	R*	R*	NR	NR	R	R	R	NR	NR	R†		R*	R	NR	R	NR	NR	NR
	Sulphuric Acid	Conc. 77.0% 60° Be.	0.0	R*	R*	NR	NR	NR	NR	NR	NR	NR	R**		R*	NR	R	—	NR	R	NR
	Sulphuric Acid	N 4.75%	0.3	R*	R*	NR	NR	R	R	R	NR	R	R**		R*	R	R	R	NR	R	NR
	Sulphuric Acid	N/10 0.49%	1.0	R*	R*	NR	NR	R	R	R	NR	R	R**		R	R	R	R	R	R*	R
	Sulphuric Acid	N/100 0.049%	2.1	R*	R*	NR	NR	R	R	R	NR	R	R**		R	R	R	R	R	R*	R
	Nitric Acid	Conc. 68.0% 40° Be.	0.23	R*	R*	NR	NR	NR	NR	R	R	NR	R**		NR	NR	NR	—	R*	R*	R*
	Nitric Acid	N 6.30%	1.0	R*	R*	NR	NR	NR	NR	NR	R	NR	R**		NR	NR	NR	—	R*	R*	R*
	Nitric Acid	N/10 .63%	2.0	R*	R*	NR	NR	NR	NR	R	R	NR	R**		NR	NR	NR	—	R*	R*	R*
	Phosphoric Acid	N 3.90%	2.0	R*	R*	R	NR	R	R*	R	NR	R	R**		R	R	R	R	—	—	—
	Phosphoric Acid	N/10 0.39%	1.5	R*	R*	R	NR	R	R*	R	NR	R	R**		R	R	R	R	—	—	—
H	Acetic Acid	N 5.96%	2.4	R*	R*	R	NR	R	R	R	R	R	R**		R*	R	NR	R	R*	R*	R*
H	Acetic Acid	N/10 0.60%	2.9	R*	R*	R	R	R*	R*	R*	R	R	R**		R*	R	NR	R	R*	R*	R*
H	Acetic Acid	N/100 0.060%	3.4	R*	R*	R*‡	R	R*	R*	R*	R	R	R**		R*	R	NR	R	R*	R*	R*
$(COOH)_2$	Tartaric Acid	N/10 0.75%	2.2	R*	R*	R*‡	R	R*	R*	R*	NR	R	R**		R*	R	—	—	R*	R*	R*
$(CHOH)_2COOH$	Malic Acid	N/10 0.67%	2.2	R*	R*	R*‡	R	R*	R*	R*	NR	R	R**		—	R	—	—	R*	R*	R*
$(COOH)_2H_2O$	Citric Acid	N/10 0.64%	2.2	R*	R*	R*‡	R	R*	R*	R*	NR	R	R**		R*	R	—	—	R*	R*	R*
$CH_3CHOHCOOH$	Lactic Acid	N/10 0.90%	2.4	R*	R*	R*‡	R	R*	R*	R*	NR	R	R**		R*	R	—	—	R*	R*	R*
	Sod. Bicarbonate	N/10 0.84%	8.4	R	R	R	R	R*	R*	R*	NR	NR	R***		—	R	R	—	R*	R*	R
	Sod. Carbonate	N/10 0.53%	11.8	R	R	R	R	R*	R*	R*	NR	NR	R***		—	R	R	—	R*	R*	R
	Am. Hydroxide	N/10 0.35%	11.1	R	R	R	R	R	R*	R*	NR	NR	NR		R	R	R	—	R*	R*	R
	Sod. Hydroxide	N/10 0.40%	13.0	NR	NR	NR	NR	R*	R*	R*	NR	NR	NR		—	R	NR	—	R*	R*	R
	Pot. Hydroxide	N/10 0.56%	13.0	NR	NR	NR	NR	R*	R*	R*	NR	NR	NR		—	R	NR	—	R*	R*	R
H_3PO_4	Trisod. Phosphate	N/10 1.37%	12.0	NR	NR	NR	NR	—	—	—	NR	NR			—	—	NR	—	—	—	—
	COMPOSITION ▸			Borosilicate	Borosilicate	Borosilicate	Borosilicate	99.4 pure	60% to 70% ni- 27% to 30% copper; 1% to 3% iron; 0.05 to 0% manganese; 0.08 to 1.0% silicon; 0.5 to 0.5% carbon.	80% nickel, 13% chromium, 6.5% iron	99.4% to 99.6% pure	99.9% pure									

* Resist at Room Temperature.
† Resist at Boiling Point.
‡ Resist up to boiling point, providing ferric chloride content low ... is recommended in preference to Durichlor.
§ Like Durion and Durichlor resistant.
** Stainless.
*** Glass suitable for certain service at elevated temperatures.
Resistivity ratings do not make allowance (except in the case of ... ion where it is no problem) for the possible effects of turbulence ... which may break down protective, corrosion-product layers ... accelerate corrosion; nor for the effect of impurities or corro- ... ons. However, the rating on lead for phosphoric acid assumes ... ivity phosphoric, C.P. phosphoric attacks lead.

The comparative resistance of various materials to acid corrosion is covered in Table I above (available on request). As useful as these materials are for many purposes, you will note that Pfaudler glass-lined steel stops corrosion under more conditions than any other. That fact alone makes it many more times useful to you . . . at a cost which merits its careful consideration for almost any acid process.

So start the reaction right by utilizing Pfaudler glass-lined equipment. It's resistant not only to all acids, except H F, but is available in many *standard* designs in the form of reactors, stills, heat exchangers, mixers, tanks, etc. Where special designs are required, you will find Pfaudler's sixty-two years of experience mighty helpful. The Pfaudler Co., Rochester 4, N. Y.



Abbott Laboratories, Chicago, Ill., obtain maximum processing flexibility with this glass-lined steel pilot plant assembly.

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Conditioning Corp., 114 E. Price St., Linden, N. J. As ordinarily operated, demineralizing systems do not remove silica, since that compound is largely non-ionized. This is of little importance except in the case of boiler water for high pressure plants. The new process employs a hydrogen zeolite unit followed by an anion exchange unit, the conventional step-up being modified in a way to accomplish removal of the silica. This is done by adding a fluoride such as sodium fluoride to the raw water entering the hydrogen zeolite unit. Here the fluoride is converted into hydrofluoric acid by a resin type of acid-regenerated cation exchange material. The hydrofluoric acid then combines with the silica to form fluosilicic acid while at the same time the hydrogen zeolite is also converting the other dissolved salts in the raw water into their corresponding acids.

In the second-stage anion exchange unit, the fluosilicic acid and the other acids formed in the cation exchanger are removed by an alkali-regenerated anion exchange resin said to be of high capacity. The process thus removes both silica and hardness from the raw water. In a modification of the process, the silica can be removed without the addition of fluorides by means of a special anion exchanger following the standard demineralizing equipment.

Series S signalling timer

8. Signalling Timer

DESIGNED to command visual and audible attention the instant a time interval is completed, the new Series S signalling timer introduced by Industrial Timer Corp., 110 Edison Place, Newark 5, N. J., provides for

FOR MORE INFORMATION
See Reader Service
Coupon on pages 155-156

VICTOR Chemicals

FOR 50 YEARS... VICTOR CHEMICALS for everyday living

for... FLAMEPROOFING

VICTOR CHEMICAL WORKS

Today, phosphate of ammonia is generally recognized as the most effective flameproofing agent for highly combustible cellulose fibers. When used to flameproof textiles and paper, solutions of Victor Ammonium Phosphate are usually applied by dipping, spraying, or brushing. In treating wood and timber, ammonium phosphate solutions are usually applied under pressure in autoclaves. ¶ Victor Chemicals used in flameproofing include: **Diammonium Phosphate** (pH of 1% solution 8.0), **Monoammonium Phosphate** (pH of 1% solution 4.5), **Fyrex** (a neutral crystalline ammonium phosphate), **Flexible Fyrex** (also a neutral product to which softening agents have been added to prevent treated materials from adhering to drying rolls, plates, or forms, and to preserve flexibility), **Special Flexible Fyrex** (provides rapid penetration because of added wetting agents and preserves flexibility by inhibiting the growth of large crystals on drying).

VICTOR CHEMICAL WORKS, 141 W. Jackson Blvd., Chicago 4, Ill.

NEW YORK • KANSAS CITY • ST. LOUIS • NASHVILLE • GREENSBORO, N. C.

Plants: NASHVILLE • MT. PLEASANT, TENN. • CHICAGO HEIGHTS, ILL. • VICTOR, FLA.

Features that reduce the danger of contamination can be *built into* your stainless steel processing vessels. These are: rounded corners – a finish sufficiently high for your application—sound welds, ground and polished flush with the parent metal surface—free from pits, holes and undercuts in which reagents can lodge.

Because we work exclusively with stainless steel and alloys, S. Blickman, Inc. assures construction that reduces danger of contamination to a minimum. We have the tools and dies needed for proper round corner construction – special polishing machines that provide the exact finish for your application—experienced craftsmen particularly trained in the problems encountered in welding stainless steel and alloys. For processing equipment that reduces losses from contamination, consult with us.

S. BLICKMAN, Inc., 608 GREGORY AVE., WEEHAWKEN, N. J.

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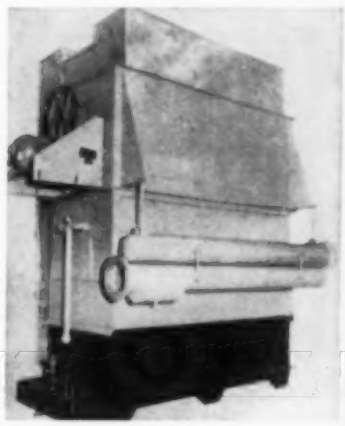
Guards Alloys in Fabrication

SEND FOR THIS VALUABLE BOOK
A request on your letterhead will bring our guide, "What to Look for When You Specify Stainless Steel for Your Processing Equipment."

CORROSION RESISTANT PROCESSING EQUIPMENT

TANKS • KETTLES • STILLS • HEAT EXCHANGERS • AGITATORS • MIXERS • TOWERS • PIPING

automatic closing or opening of a circuit at the end of an elapsed time and operates additional buzzers, bells or lights at remote locations. When the pointer on the timer is manually set to the required interval shown on the dial, a circuit is closed which operates a pilot light indicating that the time interval has started. The moving pointer revolves anti-clockwise toward zero, at any instant showing the exact elapsed time. When the interval is completed, the audible alarm sounds and the pilot light goes out, the sound continuing until the operator either starts the next timing interval or shuts off the timer. Timers are available for maximum intervals from one minute to three hours, for 115 or 230 volt a.c. at 25, 50 or 60 cycles.



Evaporative aftercooler for compressed air

9. Aftercooler

EVAPORATIVE cooling is employed to provide the refrigeration necessary in the Aero aftercooler produced by the Niagara Blower Co., 405 Lexington Ave., New York 17, N. Y. This device, intended for cooling compressed air discharged by compressors, and condensing and removing the water vapor contained in it, passes the air through coils in a spray chamber where atmospheric air is drawn through by fans, evaporating a portion of the recirculated spray water and removing approximately 1,000 B.t.u. per pound of water evaporated. The new model improves efficiency by reason of arranging the compressed air coils laterally across the spray chamber and introducing the compressed air through an oversized manifold located lengthwise on the outside of the casing. Frictional loss in the compressed air is reduced and greater contact with the evaporating spray is thereby gained.

10. Pressure Relief Valve

SIMPLIFIED construction is used in a new relief valve, for pressures up to 10,000 psi., which has been introduced by Farris Engineering Corp.

EXPERIENCE KNOWS THE SHORT-CUTS

IN the north woods, the guide is followed because of his experience, his knowledge of the existing short-cuts, his ability to "get there" with least expenditure of time and energy. Experience and knowledge and successful accomplishments give to the engineers and technicians of Chemical Plants Division a status as guides in the world of the process industries. Out of their experience, they know the short-cuts to profitable new process planning and plant construction.

The Chemical Plants Division is a complete, self-contained engineering and construction organization. Its exceptionally capable services conform in every respect with the highest technical and professional standards. It designs, builds and places into operation entire process plants.

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321 Penn Avenue, Pittsburgh 22, Pa.

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OF BLAW-KNOX CONSTRUCTION COMPANY

NEW DESIGNS FOR IMMERSION HEATERS

Amersil's* research has produced a new immersion heater which can be:

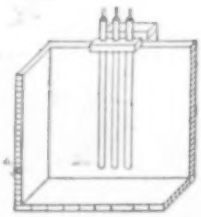
Quickly and easily installed.

Occupies less space than conventional types.

Offers a minimum of obstruction.

Provides greater radiating surface with multiple units than with a single large unit.

Will not contaminate the product.



Is chemically resistant to boiling concentrated acids. *(Not resistant to Hydrofluoric acid or alkalies)*

Write for the new Amersil Catalog for more complete details.

*Trade Name Registered

AMERSIL COMPANY Inc.

CHESTNUT AVENUE ENGELHARD HILLSIDE 5, N. J.

Oleum has no effect on MASTERS ANTI-ACID LUBRICANT. Neither has Cyanide, Nitric, Phosphoric or any other inorganic (mineral) acid, or mild caustic. This high grade lubricant was specially compounded for severe chemical service. War developed, it has been tested under practical operating conditions. Acid pump packings will last longer and give more trouble-free service when MASTERS ANTI-ACID LUBRICANT is worked into the packing fibres. Injected into the lantern ring using a grease cup in the usual way, it will provide positive protection against direct acidic attack or the corrosive action of vapors. Priority will be given to 6 QUART orders @ $1.50 per QUART. Without qualification MASTERS ANTI-ACID LUBRICANT is unconditionally guaranteed.

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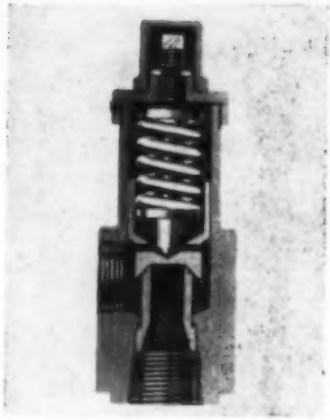
86 West Chippewa St. Buffalo 2, New York

PLAN TO ATTEND PACIFIC CHEMICAL EXPOSITION

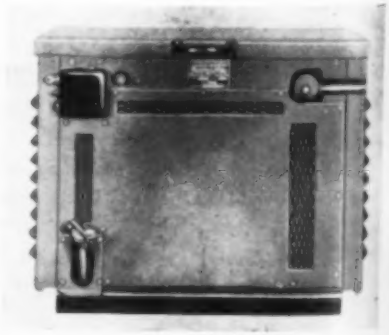
SAN FRANCISCO CIVIC AUDITORIUM

OCTOBER 21ST TO 25TH INC. 1947



High pressure relief valve

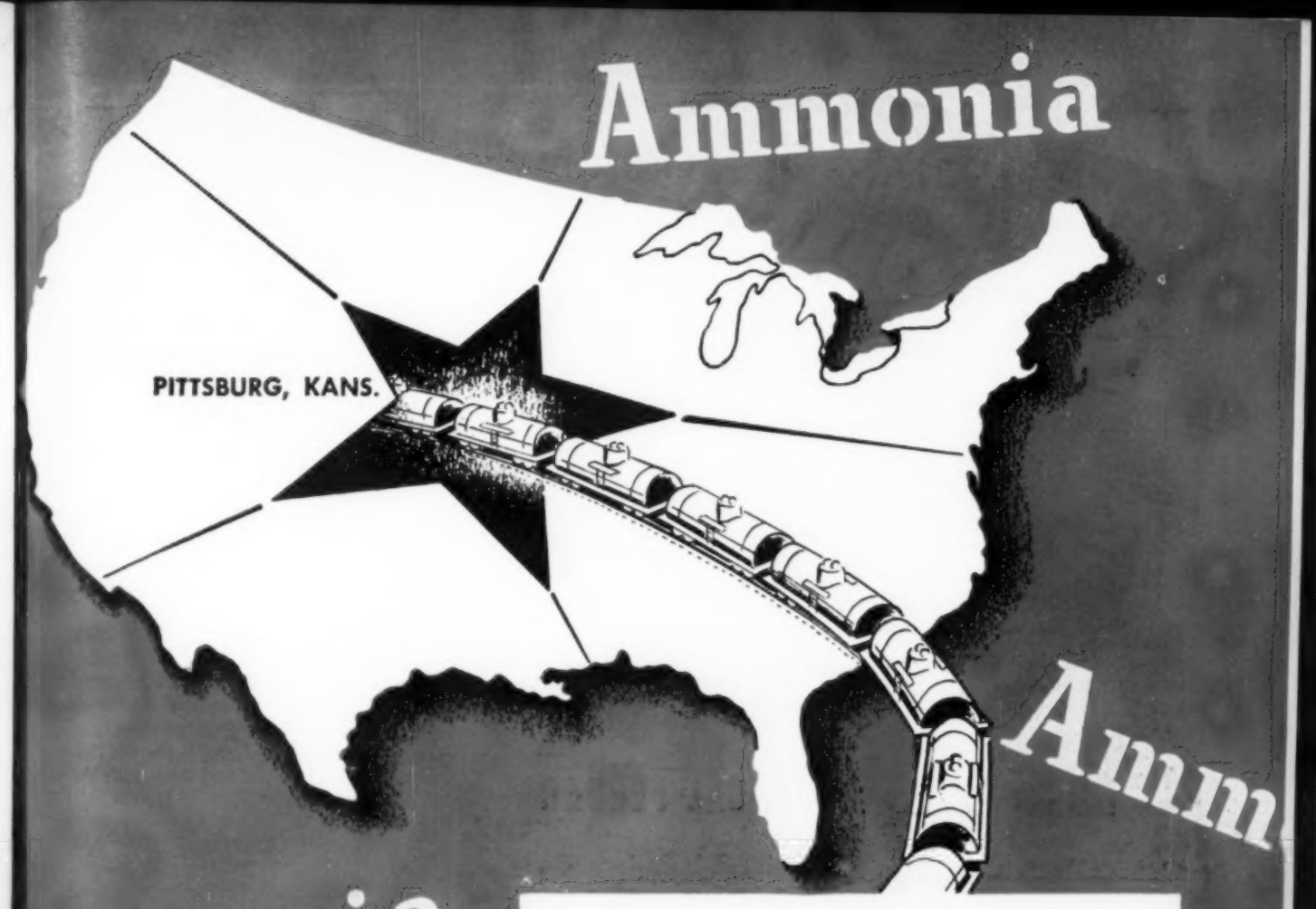
458 Commercial Ave., Palisades Park, N. J. The valve is fabricated completely from bar stock, either bronze, cold-rolled steel or stainless steel, depending on the service. In any case, the disk and nozzle are of stainless steel. Body sizes include ¼, ⅜ and 1 in. The valves have interchangeable nozzle inserts to provide proper capacity at set pressures in three ranges, namely, 2,000, 5,000 and 10,000 psi. for each size. The valve is claimed to have an exceptionally high flow efficiency, with a coefficient approximating unity, which is obtained by virtue of the high lift of the disk brought about by the high kinetic energy of the discharge developed by venturi action in the nozzle. Through design improvements the valve requires a reduced number of parts and offers additional advantages such as complete inclosure of the high carbon-steel loading spring, and the use of a nozzle seat well above the drain line so that it remains dry and is not subject to accumulations of scale or sediment.



Gas-electric drive for hand-lift trucks

11. Lift Truck Drive

GAS-ELECTRIC drives for motorized hand-lift trucks, that can be supplied installed by the truck manufacturers, or can be used to convert present battery-operated trucks by making slight alterations to the truck chassis, are being produced by the Ready Power Co., 3826 Grand River Ave., Detroit



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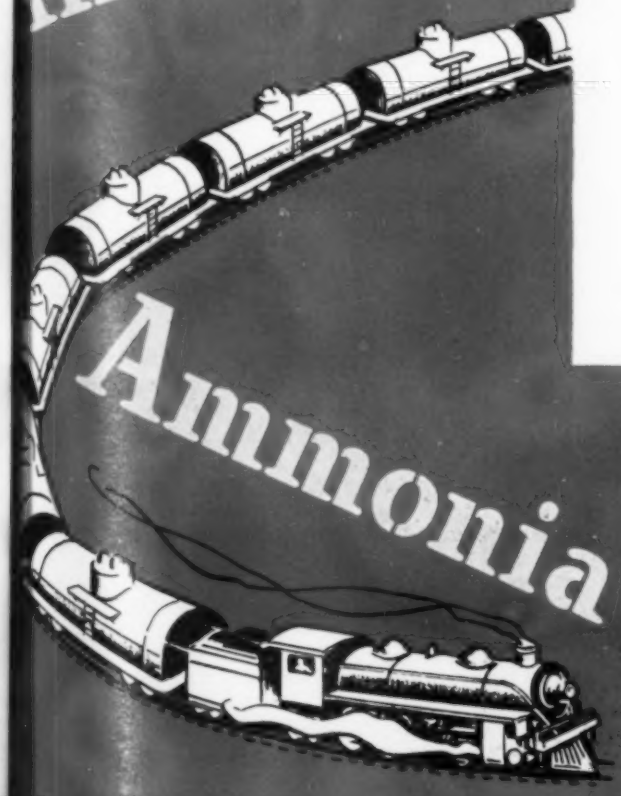
Commercial grade: 99.5% NH_3; maximum moisture content, .05%. Typical Analysis: 99.95% NH_3; .03% moisture; 2-3 ppm oil.

AQUA AMMONIA:
26° Baume grade, 29.4% NH_3 content. Color: water white. No H_2S or pyridine content.

For orderly, "as planned", deliveries, it pays to schedule your orders from Spencer's centrally located Pittsburg, Kansas, works, which is hundreds of miles and days closer to you. Phone or wire us today.



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Executive and Sales Offices, Dwight Bldg., Kansas City 6, Mo.
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SPECIFICATIONS

Maximum Chemical Output per Day—12½ gallons with ⅜" piston; 50 gallons with ¾" piston.

Capacity of Chemical Tank—10 gallons.

Piston Sizes—⅜" and ¾"

Overall Size—1'2" wide—3'3" long—2'1" high.

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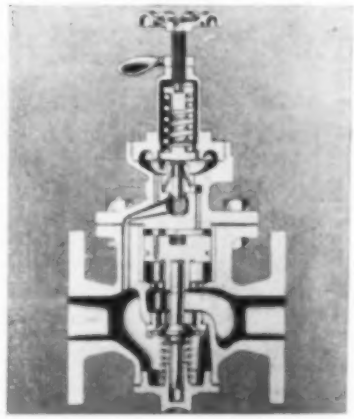
FOR MORE INFORMATION
See Reader Service Coupon on pages 155-156

8, Mich. The Ready-Power unit, Model Z-12, is a small version of this company's standard units used for electric industrial trucks. The unit supplies peak voltage at all times and having once been started, requires no further attention on the part of the operator. The truck is therefore said to be able to handle 25 to 50 percent more loads per day. A special feature is an adjustable walking-speed control which gives three speeds that are entirely independent of the control mechanism of the truck. The unit, housed in a heavy steel inclosure, weighs 600 lb. and requires a space of approximately 14x24x32 in. It consists of a four-cylinder gasoline engine, completely self-starting, a starter battery, a generator, a fuel tank and the necessary accessories.

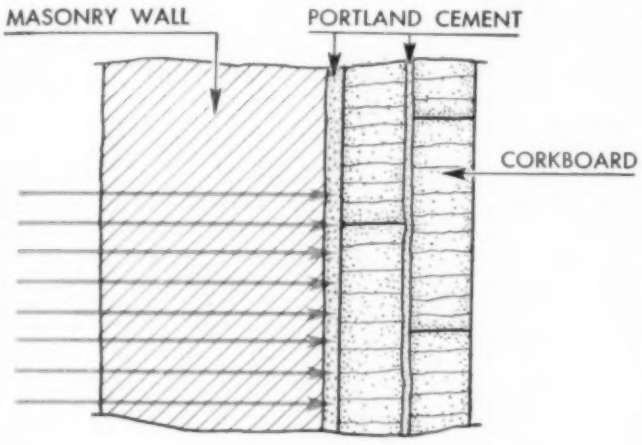


Throttling type unloading valve

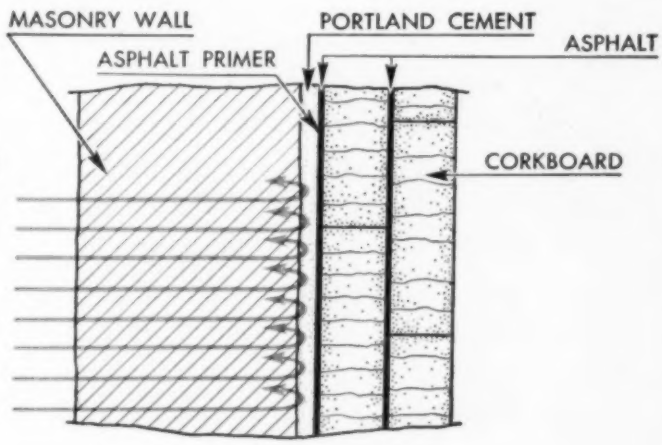
12. Unloading Valve

Sizes from ½ to 4 in., for inlet pressures from 25 to 300 psi. and inlet temperatures to 550 deg. F., are available in a new throttling-type unloading valve, Class UL, for steam, air or gas, that has been announced by the Leslie Co., 64 Delafield Ave., Lyndhurst, N. J. The valve is applicable wherever a throttling type regulating valve is required to maintain constant inlet pressure by relieving the excess to a lower-pressure system. A feature claimed for the operation is smooth throttling control during the entire cycle of operation, combined with quick action under sudden pressure variations. Features of the valve include a high-pressure bronze body, renewable wearing parts, a hard-surfaced

HOW ASPHALT STOPS AIR



Use of portland cement mortar to install insulation permits air and moisture infiltration.



Erection of insulation by the asphalt specification seals out moisture laden air.

MOST low-temperature insulation today is erected by using the asphalt specification. Twenty-five years ago, most of it was erected in portland cement mortar. This change in specifications has greatly improved the efficiency of low-temperature applications.

In the 1920's the average temperature required in refrigerated spaces was about 32° F. Even at that temperature, portland cement without moisture protection was not entirely satisfactory. For portland cement alone, like most materials, can't keep out air. One square foot of 13-inch brick wall, with ½" of portland cement plaster, at 40 pounds pressure allows more than 100 cubic feet of air to pour through in an hour. This air carries moisture which condenses, lowers insulating efficiency, and weakens the insulation bond.

In addition, when processing and holding temperatures began plummeting down—to zero and 30 below—more trouble started. The air-pressure and vapor-pressure differentials between the inside and outside of refrigerated rooms and buildings grew wider apart. And the moisture pouring into the structure turned to ice, often pushing the insulation from the wall.

The Armstrong Research Laboratories developed the asphalt specification after exhaustive tests of many different erection methods. This specification overcame the weakness of the portland cement method and has since become a standard in the industry. Asphalt, it was found, is an excellent adhesive—and because its permeability to air is practically zero, it eliminates moisture penetration, the chief weakness of the portland cement method.

The asphalt specification still uses portland cement as a back plaster to true up masonry walls. But it also calls for a coat of asphalt priming paint over trued-up masonry walls, plus erection in hot asphalt. This has proved to be a most practical method—effective, easy to handle, low in cost. It is also typical of Armstrong research and product improvement. Many important developments in the low-temperature insulation field have come from Armstrong and there will be others in the future.

For the complete specifications write today to Armstrong Cork Co., Building Materials Division, 3308 Concord Street, Lancaster, Penna.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service For All Temperatures

From 300° Below Zero

To 2600° Fahrenheit

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Type 10CB1 Level Control outperforms all other level controls. It accurately maintains *predetermined* levels for liquids or powders. Extensively used for control of water, milk, beer, acids, caustics and most other chemicals in Chemical Process, Food and Sewage fields when the ultimate in control is desired. Special fittings for sanitary installations meet all health board requirements.

The unique principle of Photoswitch design permits contact with liquid under control only by stainless steel probe rods. No floats or other moving parts required. Accuracy independent of temperature and pressure. Low voltage A.C. in probe circuit prevents electrolytic action. Yet amplification through power circuit gives positive control of signals, valves or pumps.

Use Type 10CB1 for single level indication • on-and-off pumping • boiler feed water • boiler condensate • all types of pump programming • The most generally adaptable level control available.

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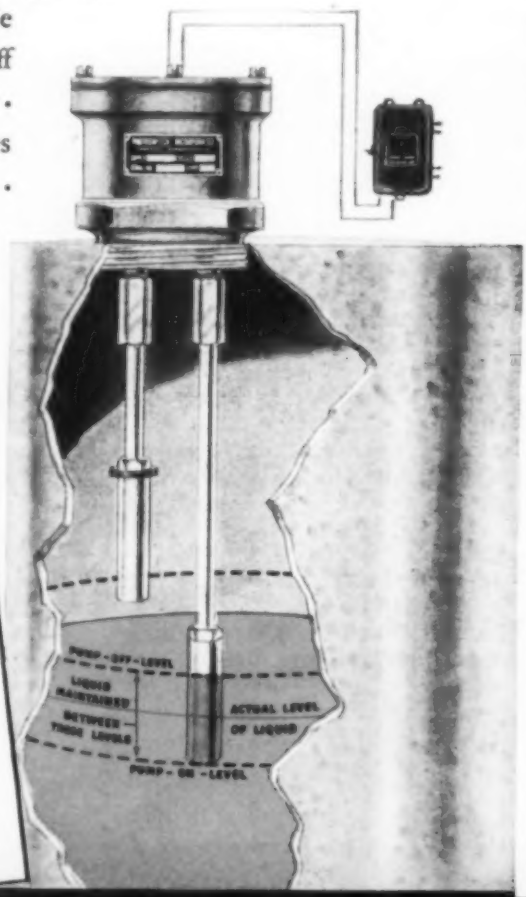

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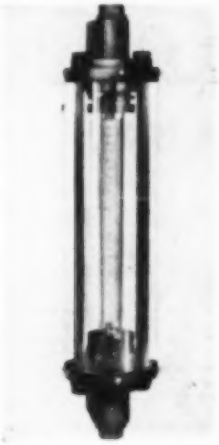
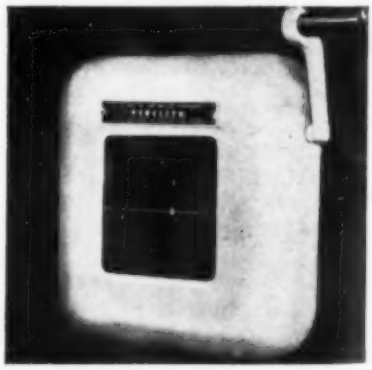
seat ring, hardened stainless steel main and controlling valves, a bronze piston, corrosion-resistant piston rings and a phosphor bronze diaphragm.



Vapor-proof rotameter

13. Vapor-Proof Meter

A CLEAR plastic tube inclosing the entire frame and metering tube assembly has been employed by Schutte & Koerting Co., Philadelphia, Pa., in vapor-proofing one model of the rotameter flowmeter manufactured by that concern. This protection not only prevents possible damage to the metering tube, or to the packing glands and bolts where the atmosphere is corrosive in character, but it also acts as a guard against leakage of fumes where toxic gases are being metered. In the latter case, a vent in the end fitting may be provided for the installation of a small pipe to carry fumes outside the building.



Perfecto furnace observation port

14. Observation Port

NEWLY DESIGNED and air-cooled, an observation port for use in all types of industrial furnaces has been introduced by the A. P. Green Fire Brick Co., Mexico, Mo. Weight of the port is only 14 lb. and it is claimed that it can be installed readily in any new or old furnace wall, including those constructed of common brick, fire

ALCOA ALUMINUM CONDENSER TUBES

cost less! And give you these advantages . . . .

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Alcoa Alclad Aluminum Condenser Tubes are specifically designed to resist corrosion, especially under conditions which might normally cause perforation. Outstanding performance has been obtained with many types of aggressive waters on the interior of these tubes, and they have been successfully used with ammonia, hydrogen sulfide, carbon dioxide, and many organic compounds.

Aluminum has high thermal conductivity . . . condensers and heat exchangers work at high efficiency.

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And most important! Alcoa Aluminum Condenser Tubes cost less than other tubes. Compare their cost with that of the tubes you are now using.

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MORE people want MORE aluminum for MORE uses than ever

ALCOA FIRST IN **ALUMINUM**

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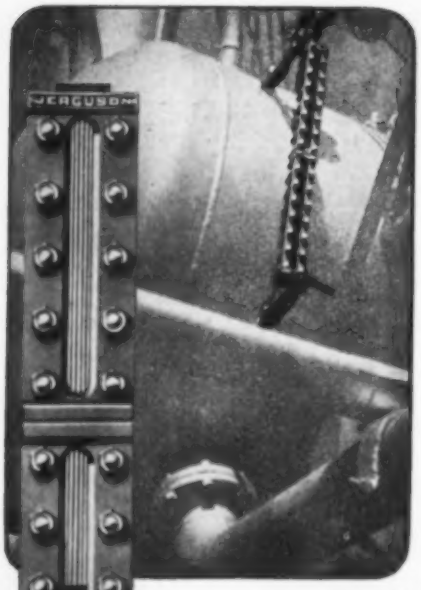

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You get a lot of plus values . . . and avoid a lot of failure headaches and possible accidents . . . by using Jerguson Flat Glass Gages for every liquid level indicating use.

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brick or incased in steel. The port gives a wide angle of vision to permit observing furnace and grate conditions without disturbance of the firing cycle. The user is protected by a blue Pyrex window which inturn is protected from the heat when not in use by a ribbed shutter operated by the handle shown in the accompanying illustration.

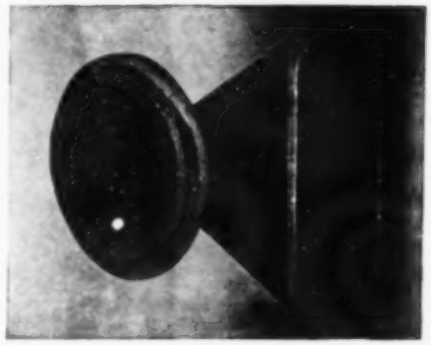
Equipment Briefs

15. AN AUTOMATIC relief method for hydraulic systems has been developed by Pesco Products Division of Borg-Warner Corp., 310 South Michigan Ave., Chicago 4, Ill., in a novel gear type pump. This pump is essentially two pumps within a single housing. A pilot valve controls an opening in the passage communicating from the outlet port to the rear of the movable bearings in the cover of the pump. When a specified pressure has been reached in the hydraulic system, the pilot valve closes the passage, eliminating pressure loading. Pressure on the gear teeth area then forces the cover bearings away from the gears and immediately a large section of the pump ceases to deliver fluid with a consequent decrease in power input requirements. The small section of the pump continuing to deliver fluid meets system leakage requirements, any excess liquid bypassing through a relief valve. Once system pressure drops, the pilot valve opens again, puts pressure on the floating bearings and restores operation in the large section of the pump.

16. QUICKLY folding up to a convenient 10 ft. length, a new gravity conveyor introduced by Wilkie Co., 5520 Arch St., Philadelphia, Pa., features telescopic construction. The conveyor comes in three sizes, 10 to 20 ft., 10 to 30 ft. and 10 to 40 ft., and employs a frame construction of ½ by 1½ in. channel iron, with ball bearing skate wheels. The legs are adjustable and are provided with 3-in. casters for easy moving.

17. IMPROVEMENTS have recently been incorporated in the high intensity magnetic separator offered by the Exolon Co., 951 East Niagara St., Tonawanda, N. Y. As a result of improvements in the copper-power ratio, the amount of

FOR MORE INFORMATION
See Reader Service
Coupon on pages 155-156



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CHROMALOX

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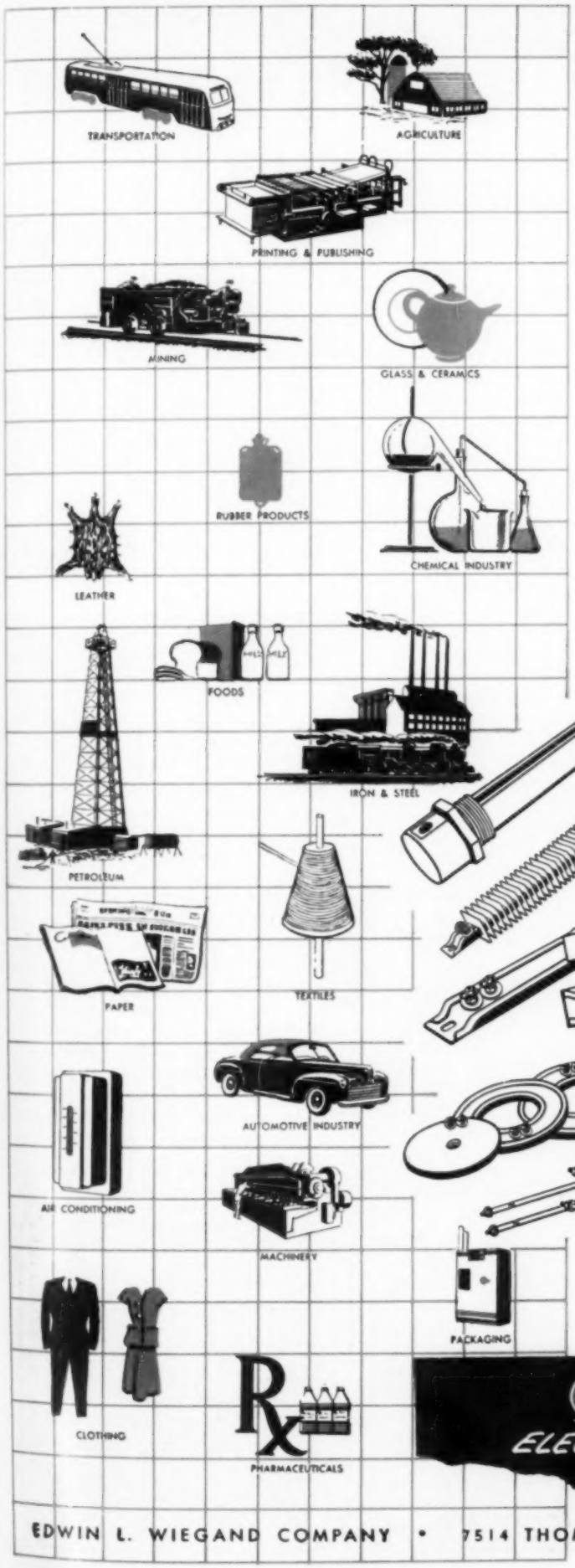
HEAT



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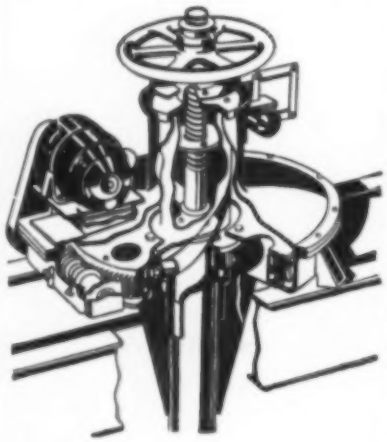
Scraper Breakage is OUT OF STYLE

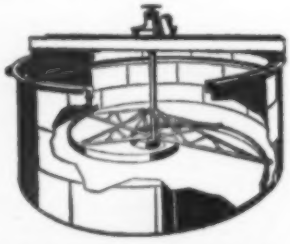


. . . with Hardinge "AUTO-RAISE" Thickeners

The ingenious mechanism shown above automatically lifts the entire thickener scraping assembly upward when an overload of pulp occurs anywhere in the tank bottom.

Restarting after power failure will not cause scraper breakage when "Auto-Raise" is at work.

Another feature of the Hardinge Thickener is the double spiral scraper (shown below) which removes solids rapidly — prevents "pile-ups".



Ask for Bulletin 31-D

HARDINGE COMPANY INCORPORATED

YORK, PENNSYLVANIA — 240 Arch St. • Main Office and Works
NEW YORK 17—122 E. 42nd St. • 205 W. Wacker Drive—CHICAGO 6
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power needed is now less than formerly. Adjustable pole noses are now available for separating materials which vary in magnetic susceptibility, or to accommodate different rates of feed. Oversized driving mechanisms are now provided, with both constant-speed and variable-speed drives available. These and other improvements are said now to increase yield and improve the quality of concentrates on weakly magnetic materials.

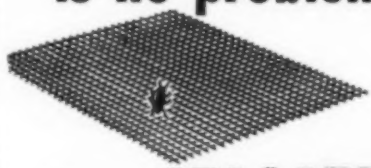
18. RECENT improvement in the barrel handler produced by the Falstrom Co., Box 118, Passaic, N. J., has resulted in easier operation of the device previously described in these pages. The mechanical linkage of the lifter is adjustable to give several degrees of leverage, permitting handling drums up to 750 lb. gross weight. Pick-up has been simplified with an improved safety lock chain arrangement encircling the drum. Self-locking safety stops are provided to give finger-tip safety control. The drum may be locked in either the vertical or pouring positions.

19. AN IMPROVED all-purpose tube cleaner cutter head has been announced by the Lagonda Division of the Elliott Co., Springfield, Ohio. Designated as the 3300 Series, the new design, which features a non-threaded cutter pin and increased cutter surface, is for use in straight tubes in refinery and other heavy-duty service, for cutting out scale, carbon and other layers of accumulated deposits from the interior surfaces of tubes and pipes. The head is said to be effective in both light and heavy scale and to have the largest expansion ever obtained in a swing-frame head, enabling it to be used in several sizes of tubes or in heavy tubes which are irregularly worn.

20. BELT CONVEYORS using flat steel belts have previously been produced by Sandvik Steel, Inc., Port Authority Building, New York 11, N. Y. However, the company is now prepared to supply carbon or stainless steel belts either flat or troughed. The troughed belt can be either pre-troughed or self-troughing. In the former the initial trough is given to the belt during manufacture. In the latter type the trough is produced in operation by the weight of material being carried. Either type is said to assure maximum cross sectional load carrying capacity, although the pre-troughed type is best suited to the handling of light, easy flowing materials, while heavier materials such as coal, stone and ore can be handled with the self-troughing type. The manufacturer provides complete assemblies including belt, idlers, motor and supporting structure.

MESH SIZE

is no problem



for JELLIFF

For quality wire mesh — contact Jelliff — makers of wire mesh products for over sixty years. Commercial sizes available in standard lengths of 100 feet and widths of 24 to 72 inches. Meshes of specified gauge and weave made and cut to order. Available crimped, calendered and rolled. Jelliff engineers keep abreast of current developments in new alloys, coatings and processes and apply them when studying your requirements. For best results and maximum economies, look to Jelliff.

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The C. O. JELLIFF MANUFACTURING CORPORATION
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WIRE PRODUCTS SINCE 1860

NEW PRODUCTS AND MATERIALS

Richard W. Porter, ASSISTANT EDITOR

Geon Polyblend, at the right, forms a smooth sheet after only one "pass" through a laboratory mill, while natural and synthetic rubber at the left must be further processed.

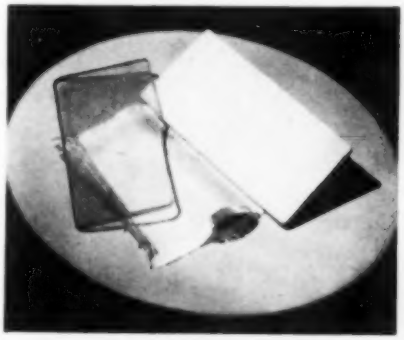
51. Geon Polyblend

COMBINING the toughness and chemical resistance of polyvinyl chloride with the solvent resistance and flexibility of nitrile rubber, Geon Polyblend 500x503 is now in commercial production by the B. F. Goodrich Chemical Co., 324 Rose Bldg., Cleveland 15, Ohio. Offering properties heretofore unavailable in a thermoplastic material, this new product is the first in a series of colloidal blend of polyvinyl chloride resin and nitrile rubber polymers. One advantage of this combination is that the characteristics of vinyl elastomers are achieved with no liquid plasticizers, since the nitrile component of the polyblend serves as a non-extractable, non-migrating, polymeric plasticizer.

This new material is said to be especially useful for extruding and calendering and is well adapted to embossing and press-polishing operations. This should make it valuable to the upholstery, shoe, electrical and packaging industries. In the electrical industry, polyblend may serve as a covering for cables containing vinyl insulated wires since there is no danger of plasticizer migration. This elimination of plasticizer transfer is also important to food packaging and adhesive application. Compounding, processing and fabrication of polyblend have characteristics peculiar to both vinyl plastic and nitrile rubber. The stock can be easily processed either on a hot or cold mill where it forms a smooth sheet after only one "pass" and, unlike rubber, does not require a "breakdown" period. For maximum physical properties the stock should be calendered like a vinyl plastic at temperatures of 300-330 deg. F.

52. Daylight Paint Colors

MANUFACTURED by the Libbey-Owens-Ford Glass Co., Toledo, Ohio, a series of interior "Daylight" paint colors are designed to lessen eye fatigue. The paint colors were first utilized during the war as a means of easing eye strain of employees engaged in inspecting small pieces of precision glass. It is claimed that 90 percent of the eye complaints were eliminated when daylight colors were applied to interior walls. The colors comprise four off-shades of white formulated to reduce glare from direct and reflected light. The color shades have been standardized by spectrophotometer records and the colors are being made available to paint manufacturers.



Both containing 10 layers of glass fabric, the transparent laminate on the left is made from V-Lite, while the opaque laminate on the right uses a different resin.

53. Transparent Plastics

SOON to be manufactured on a semi-works scale is a new plastic material recently announced by Victor Chemical Works, 141 W. Jackson Blvd., Chicago 4, Ill. In its original or monomeric form, diallyl phenyl phosphate or V-Lite, as it is called, is a colorless liquid that polymerizes to become a transparent, thermosetting, hard and strong resin. Polymerization is accelerated by the presence of 2 to 3 percent organic peroxide as a catalyst. Hardest resins have been obtained using a mixture of 3 percent benzoyl peroxide plus 0.5 percent tertiary butyl perbenzoate as a catalyst. Clear transparent sections of resin up to ¼ in. in thickness can be made at atmospheric pressure by curing 2½ to 3 hr. while raising the temperature from 85 deg. to 130 deg. C. Full polymerization may take place between this liquid monomer and methyl methacrylate, vinyl acetate, diallyl phthalate, diallyl succinate, diallyl oxalate, and unsaturated alkyd resin mixtures. Complete new sets of properties are found in copolymers when appreciable amounts of diallyl phenyl phosphonate are present.

Although all properties of the copolymers have not been investigated, certain characteristics have been noted such as an increase in flame resistance, increase in index of refraction, decrease in solubility, and increase in hardness. Certain thermoplastic ma-

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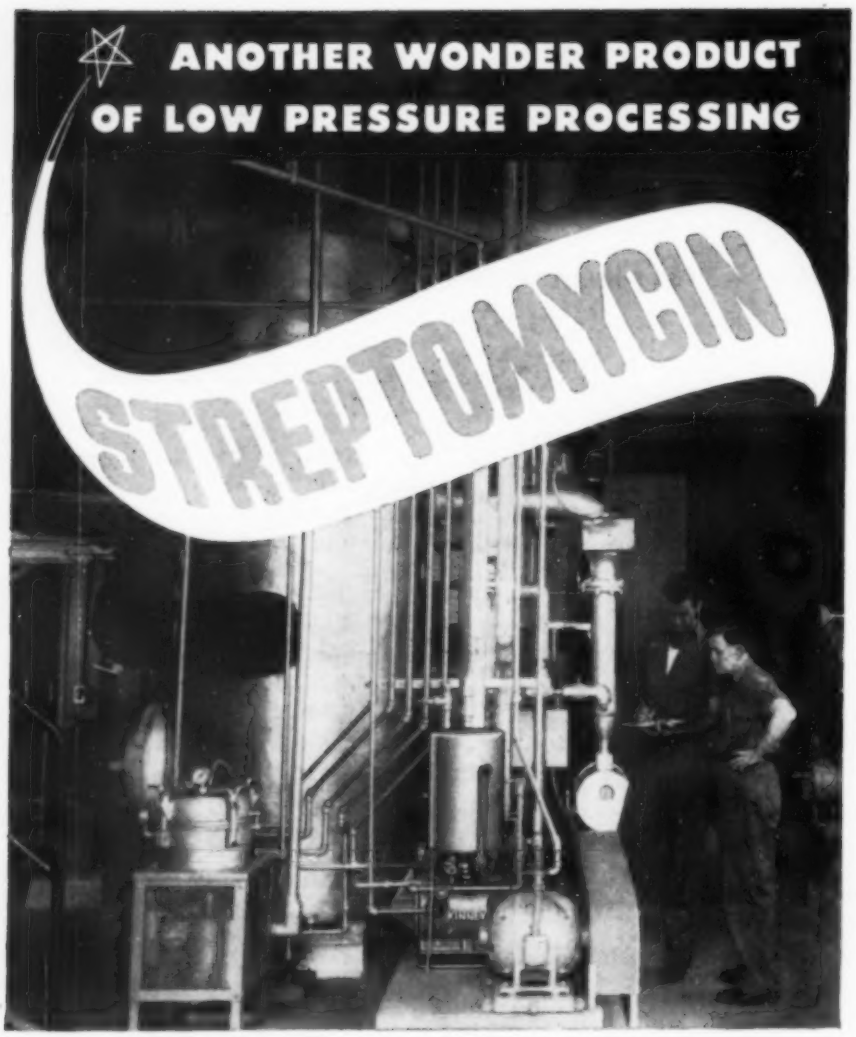
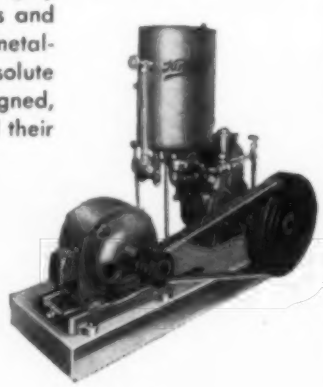
FOR MORE INFORMATION
See Reader Service
Coupon on pages 155-156



Kinney High Vacuum Pumps play an important part in the freeze-dry process at the new Streptomycin Plant of Merck & Co., Inc. at Rahway, N. J. Under super sterile conditions, vapor from the sublimation dryer is frozen in a high vacuum at —80 deg. C. in the condenser and removed as snow. Kinney Vacuum Pumps are giving highly dependable service in the production of this and many other pharmaceutical, food, optical, metallurgical and other products where low absolute pressures must be maintained. Compactly designed, Kinney Vacuum Pumps save floor space, and their fast pump down and low ultimate pressures shorten production time and reduce costs. Kinney Single Stage Vacuum Pumps produce low absolute pressures to 10 microns; Compound Pumps to 0.5 micron.



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terials such as methyl methacrylate and vinyl acetate are said to be changed by the action of this new monomer to become thermosetting instead of themiplastic. Flame resistance of the pure polymer is great enough so that it extinguishes itself within 30 sec. of removal of flame. Index of refraction has been found to be higher than most other transparent materials. V-Lite is insoluble in ether, acetone, benzene, butyl acetate, naphtha, alcohol, carbon tetrachloride, water, dilute hydrochloric acid and caustic soda solutions. Suggested applications are many. Some of these are as follows: Nonflammable coatings for decorations or veneers; windows in passenger aircraft; transparent laminates; copolymers for machine parts, and for optical uses.

54. Deodorant

UNPLEASANT odors that come from the use of plastic coatings on a variety of commodities, from tablecloths to raincoats, can be overcome and replaced by a slight but pleasing fragrance by use of Res-O-Dors manufactured by Givaudan-Delawanna, Inc., 330 West 42nd St., New York 18, N. Y. These materials are said to be inexpensive and easy to use and have no effect on the plastic material. Suggested uses for the Res-O-Dors include plastic coatings for refrigerator food covers, lettuce bags, umbrellas, shower curtains, artificial leather handbags, and other similar articles.

55. Additive Lubricant

Two new lubricants for use in aircraft engines are available from the Shell Oil Co., Inc., 100 Bush St., San Francisco 6, Calif. The first of these is called AeroShell Oil D, and was developed over a period of years through extensive laboratory and flight tests. This new oil helps to extend the period between engine overhauls and is said to reduce the replacement of engine parts. It is claimed to reduce harmful deposits in piston rings and grooves as well as on valve guides. The second product is a general purpose aircraft grease called AeroShell Grease 6 which, it is claimed, can be used to handle about 90 percent of the required aircraft lubrication including wheel bearings and general applications.

56. Surface Finishes

A LINE of clear and colored lacquers for surface finishing polystyrene plastics has been announced by the Monsanto Chemical Co., St. Louis 4, Mo. Lacquers are said to overcome the tendency of solvents to produce craz-

FUEL ECONOMY *plus* TEMPERATURE CONTROL

This waste heat boiler, shown during installation, recovers heat from tunnel kilns—a new application. Compactness of design and details of cast-iron, extended surface element construction are shown.

WASTE HEAT BOILERS GIVE BOTH

The function of waste heat boilers in chemical processing operations is two-fold —to provide close control over temperature and rate of cooling of hot, corrosive gases, and to recover heat from these gases which would otherwise be wasted.

Temperature control by other methods has proved generally uneconomical, while heat recovery and re-use to generate steam or heat water means lower fuel cost.

Constructed to resist corrosion, tubes of Foster Wheeler waste heat boilers are protected by a sheath of cast iron. Extended surface elements speed cooling and reduce gas-travel time and distance through the unit.

The complete story of waste heat boiler application in many plants is in Catalog WHB 47-4. Send for a copy to determine whether such possibilities for economy exist in your own plant.

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MARTIN CALCINER / PREHEATER

PROVIDES FOR RABBLING MATERIAL IN ATMOSPHERE TEMPERATURE UP TO 2500°F

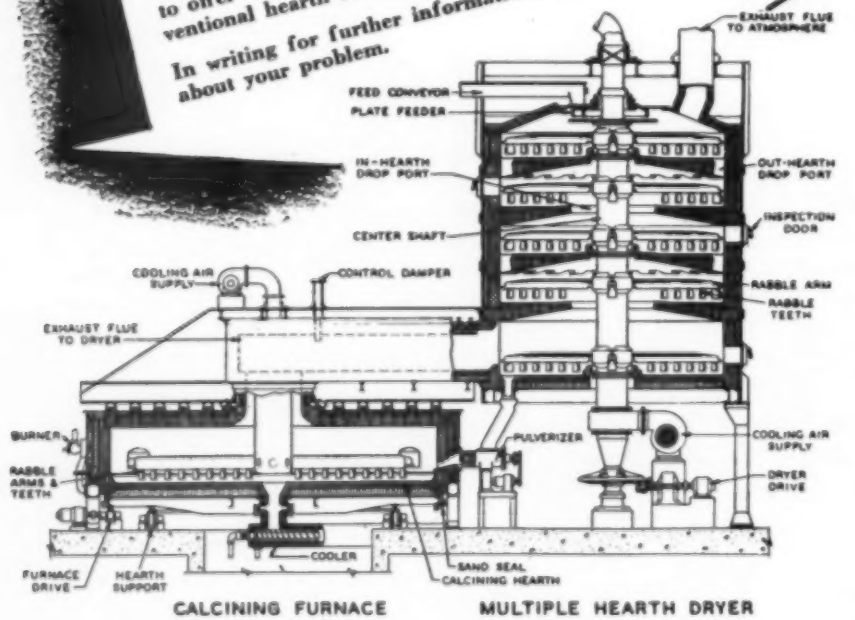
The conventional multiple hearth furnace is limited to temperatures of 1800° to 2000°F due to unavoidable conditions in which the fire brick hearths are subjected to heat from both sides.

By contrast, the calciner section of the Martin Furnace is designed to handle temperatures up to 2500°F. It's a single chamber furnace in which the brickwork can allow very high temperatures with durability and heating efficiency corresponding to other chamber type furnaces. It also has a rotating hearth in combination with a stationary rabbling device which provides for continuous operation in a most uniform manner without creating hot spots in the material bed. The stirring device is, of course, insulated and cooled internally.

The waste heat from the calciner is used to dry and/or preheat the material feeding the calciner.

If you have any calcining or roasting job which requires a temperature ranging between 1800° and 2500°F you should investigate the Martin Calciner/Preheater. If your process calls for lower temperatures, the multiple hearth section alone with its revolving rabble arms and fixed hearth has several things to offer which are great improvements over the conventional hearth furnaces.

In writing for further information, tell us in detail about your problem.



CALCINING FURNACE MULTIPLE HEARTH DRYER

Martin Furnace Division

MORSE BOULGER DESTRUCTOR CO.

211-0 East 42nd Street New York 17, N. Y.

ing in polystyrene. The lacquers are either clear or pigmented, resistant to oil and will protect the polystyrene. They can be sprayed onto the polystyrene surfaces and will dry rapidly to a hard, adherent and mar-resistant finish of high gloss suitable for an exterior finish. Wipe-on coatings or coatings applied to inlays, such as dial numerals, letterings and designs, are usually applied with a brush.

57. Methyl Magnesium Iodide

Widely used in laboratories for determination of the number of active hydrogens which are present in chemical compounds is a solution of methyl magnesium iodide in amyl ether, better known as the Zerewitinoff reagent. This reagent is now being produced by Arapahoe Chemicals, Inc., Boulder, Colorado. It is supplied as a clear, pale yellow solution in 50, 100 and 500 ml. containers.

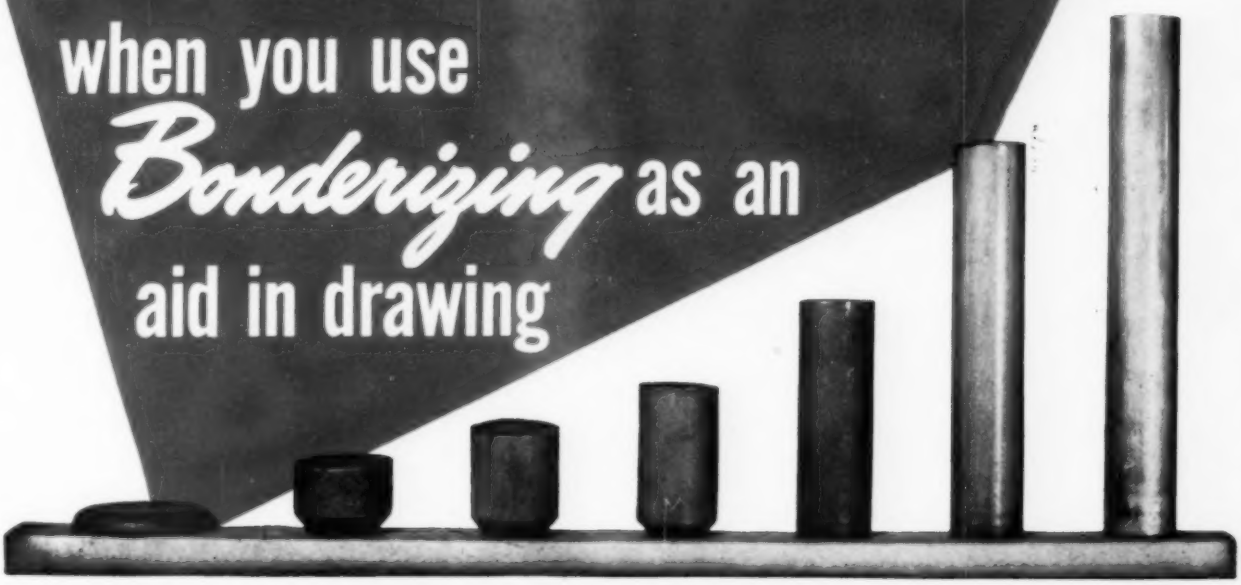
58. Urea Formaldehyde Resin

KNOWN as Uformite F-240, a new butylated urea formaldehyde type resin has been recently announced by the Resinous Products & Chemical Co., Philadelphia, Pa. Having a wide range of competability with medium and long-oil alkyds and oleoresinous varnishes, this new resin is claimed to be useful in formulations where low ratios of urea resin are required to speed up baking schedules. The high mineral thinner tolerance and good compatability at these concentrations eliminate the hazards of "throw out" and loss of gloss often encountered. Uformite F-240 is claimed to have good qualities of hardness, chemical and water resistance, and color retention to make it valuable in applications such as automotive and metal decorative finishes, including dipping enamels where a variety of medium length alkyds and varnishes are used. It is completely soluble in aromatic solvents such as xylol or toluol, in esters and ketones and may be safely diluted with aliphatic hydrocarbons.

59. Organic Intermediates

Now available in experimental quantities for development purposes, a new series of industrial chemicals, the dimethylaminomethyl phenols, has been introduced by the Rohm & Haas Co., Washington Square, Philadelphia, Pa. This series includes dimethylaminomethylphenol (DMP-10), o-dimethylaminomethyl-p-butylphenol (DMP-14), o-dimethylaminomethyl-p-octylphenol (DMP-18), and 2,4,6-tri (dimethylaminomethyl) - phenol (DMP-30). Designated as DMP because of the length and similarity of

Not 1, but 8 ADVANTAGES when you use *Bonderizing* as an aid in drawing



1. Permits use of a wider range of lubricants
2. Allows wider variation in steel composition
3. Reduces metal-to-metal contact
4. Prolongs tool life
5. Permits faster drawing speeds and deeper draws
6. Reduces number of process anneals
7. Reduces material breakage
8. Gives smoother finish to product

Here's how Bonderizing, used as an aid in drawing, acts to bring you these advantages:

The Bonderite crystals cover the work, integral with the metal itself. The crystals are nonmetallic, and act as a cushion between the die and the work. Under severe drawing pressures, the crystals stretch and are crushed, acting effectively to minimize scratching, welding and galling.

The Bonderite coating is absorbent, and thus holds lubricants more efficiently than untreated metals.

The combination of cushioning action, more positive lubrication, and the nonmetallic character of the Bonderite means less wear on tools and dies, faster draws, deeper draws, less spoilage, real savings in time and money.

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BONDERIZING Holds Paint to Metal
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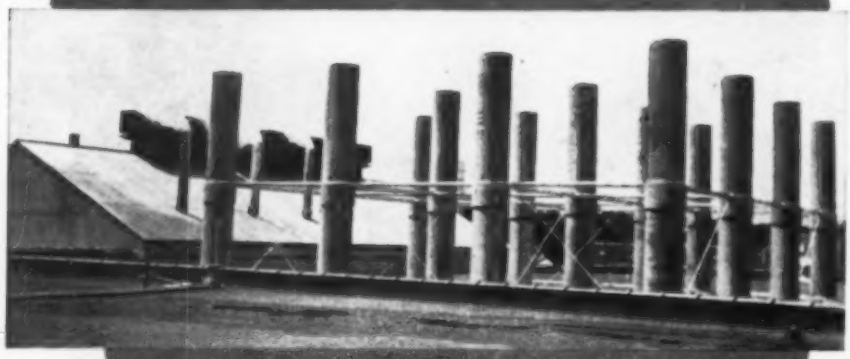
PARKER PRODUCTS CONQUER RUST

HOW TO CUT COSTS



in the venting of industrial gases, fumes, vapors

PLANT ENGINEERS in many industries are finding the answer to the problem of high venting costs in Transite Industrial Vent Pipe.

That's because this durable asbestos-cement pipe is highly resistant to many of the corrosive fumes, vapors, dusts and gases met with in industrial operations. It is rustproof and requires no painting, whether used indoors or out. Moreover, it is light in weight and easy and economical to install.

Transite Industrial Vent Pipe is made in a range of sizes up to 36" in diameter. A full line of Transite fittings provides corrosion resistance throughout the system.

Data Sheet DS Series 336 gives all the facts and is free on request. Write Johns-Manville, Box 290, New York 16, N. Y.

JM PRODUCTS

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Automobile	Drug	Glass	Potash	Shoe
Baking	Electrical	Laboratory	Pulp & Paper	Smelting
Bleaching	Explosive	Laundry	Quarrying	Soap
Boiler Works	Farm Machinery	Leather	Railroad	Soft Drink
Brewing	Food	Meat Packing	Rayon	Sugar Refining
Canning	Foundry	Metal	Refrigeration	Textile
Ceramic	Furnace	Mining	Rubber	Tool
Chemical	Furniture	Paint	Sewage Works	Water Works

Johns-Manville TRANSITE Industrial Vent PIPE

FOR MORE INFORMATION
See Reader Service Coupon on pages 155-156

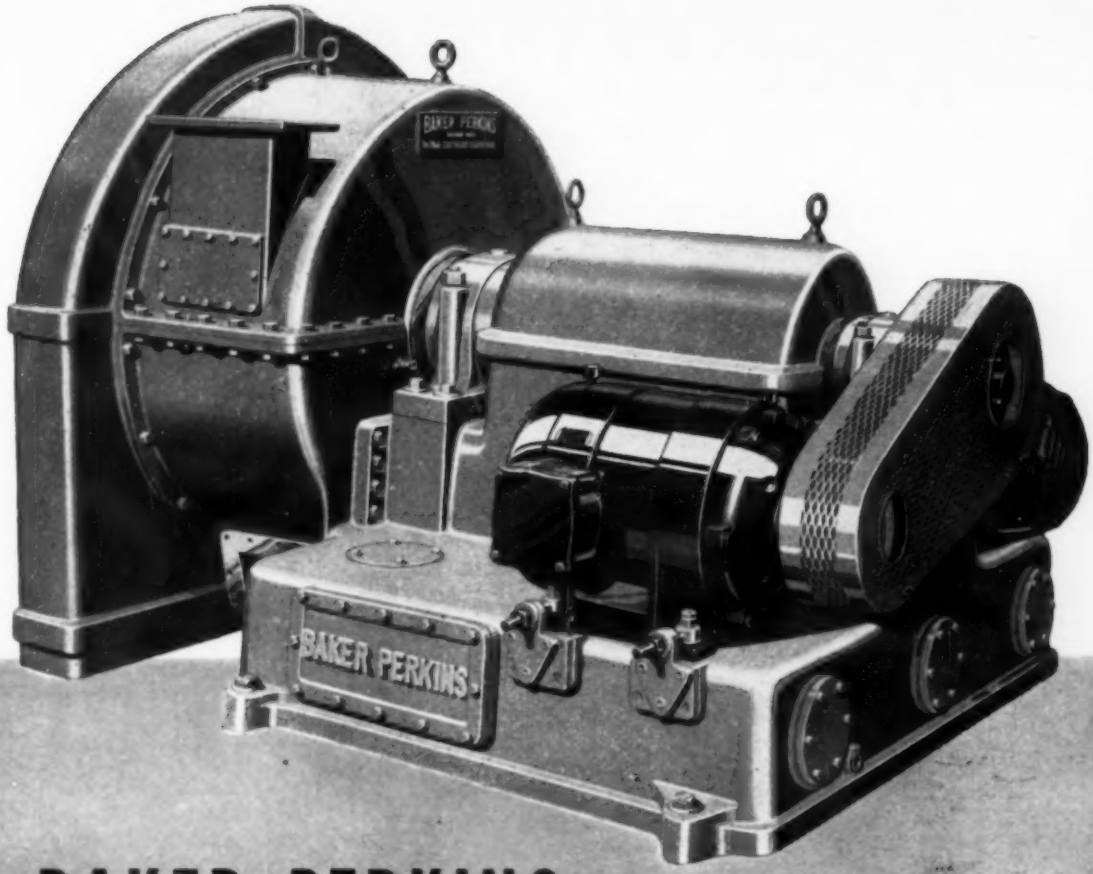
the chemical names, these products are of possible interest as intermediates for inhibitors, rust preventatives, antioxidants, emulsifiers, bactericides, neutralizers, and a wide variety of other products. DMP-14 has been used as a neutralizing agent, whereas DMP-30 may be used as a neutralizer and as a dehydrohalogenating catalyst because of its high molar ratio of tertiary amine. DMP-18 is of most interest where surface activity is desired, such as emulsification and also has bactericidal properties. This series of chemicals have two functional groups, the phenolic hydroxyl and the tertiary amino nitrogen. Most of the salts of dimethylaminomethyl phenols are water soluble, and some of the salts with organic acids are soluble in organic solvents. Both DMP-10 and DMP-30 may be considered amphoteric since they form water-soluble salts with both acids and bases. The usual nuclear reactions of phenols can be carried out with the dimethylaminomethyl phenols. These include condensation with formaldehyde, condensation with formaldehyde and amines, reaction with sulphur dichloride to form a sulphide, and reaction with diazonium compounds to form azo derivatives.

60. Household Bleach

Containing a wetting agent called QET, that is stable in a highly chlorinated solution, a new household bleaching solution has been developed by Chlorine Solutions, Inc., 6019 S. Riverside Drive, Los Angeles 22, a subsidiary of American-Marietta Co. operated by Pacific Chemical Co. Called Hy-Pro Bleach, the new product is said to have advantages over conventional household bleaches in that it is more penetrating and saturates linen and cotton fabrics better. It is also faster and more thorough than bleaching solutions marketed heretofore.

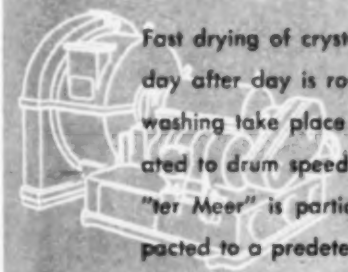
61. Grinding Coolant

DEVELOPED by the Bee Chemical Co., 63 E. Lake St., Chicago, Ill., is a new grinding coolant named Wheelyfe 85. This new coolant is a clear solution which will prevent the loading of grinding wheels even with the finest grit sizes. Because of this the

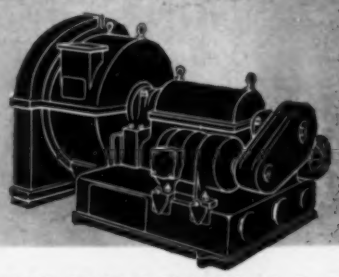


BAKER PERKINS

"ter Meer" CENTRIFUGALS dry materials at top speed



Fast drying of crystalline, granular, and other free-draining materials, with perfect consistency day after day is routine for Baker Perkins "ter Meer" Centrifugals. Charging, discharging, and washing take place while the machine is operating at top speed. The slurry is gradually accelerated to drum speed before being deposited on the centrifugal drum, hence the B-P continuous "ter Meer" is particularly adaptable to handle friable crystals. Centrifuged material is compacted to a predetermined cake thickness and passed under a fixed wash spray at predetermined speed, resulting in more efficient washing. All drum parts rotate at the same speed: there are no scrapers, rakes, or plows to disturb the material being treated and cause crystal degradation. Baker Perkins "ter Meer" Centrifugals are available in 4 sizes for handling 1½ to 20 tons of dry solids per hour. For complete particulars, send details of your processing to BAKER PERKINS INC., CHEMICAL MACHINERY DIVISION, SAGINAW, MICHIGAN.



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If you are interested in obtaining better results in grinding, emulsifying and homogenizing, write for complete details. Ask for a copy of Catalog No. 401. No obligation of course.

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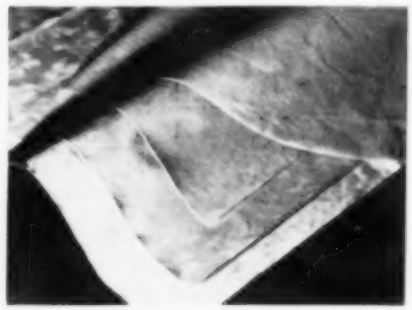
finish obtained by grinding is determined by the grit size used instead of the mirror finish obtained by the buffing action of a loaded wheel. Wheelyte 85 achieves best results when it is diluted by about 30 gallons of water. This material is said to give corrosion protection and does not become rancid during long periods of use.

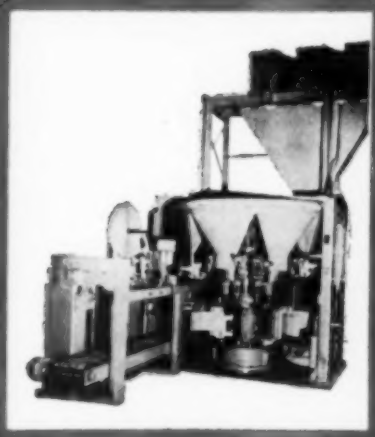


Coated fabric table coverings with plastic surface made from the new Geon polyvinyl chloride paste-forming resin; this material has a linen-like finish, is resistant to dirt, stains, cracks or peeling

62. Polyvinyl Chloride Resin

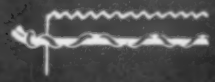
INTRODUCED by the B. F. Goodrich Chemical Co., Rose Building, Cleveland, Ohio, is a polyvinyl chloride paste-forming resin. Designated as Geon Resin 100-S-26, this new polymer is a free-flowing white powder with a specific gravity of 1.40. It is readily dispersed in plasticizer with the use of simple processing equipment. Following proper heat treatment, articles can be fabricated from the new resin and result in the same qualities as are obtained for equivalent resin-plasticizer ratios to those fabricated from standard Geon resins. Two methods are used for formulating this new resin. One is by use of a resin and plasticizer mixture where the resin is merely dispersed in plasticizer by simple curing. The other is the addition of a volatile diluent to the resin-plasticizer mixture. Straight chain aliphatics, just above the gasoline range in molecular weight are recommended as diluents. This latter method makes possible a wide range of hardness in finished products because the diluent enables the processor to retain fluidity during fabrication, even with low plasticizer content. The principal advantage of this material is the ease of processing and the use of conventional equipment. Both of these advantages eliminate, in coating operations, the necessity for heavy and expensive equipment and the shrinkage of fabrics commonly encountered in water or solvent system of coating. A variety of applications are suggested for this new resin. It may be molded, cast, coated or dipped to produce the same type product commonly made by calender-

MODEL "DA" (portable)—One operator filling and closing, can handle 2 to 4 100-lb. bags a minute . . . 6 to 12 a minute where filled bags are delivered to BAGPAKER conveyor (quickly adjustable for various bag sizes). Starting and stopping of sewing operation is automatic . . . no tape wasted.



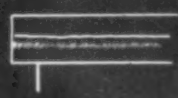
MODEL "A"—Completely automatic—extremely accurate weighing. Saves on "give away" material, labor and bag costs, thus paying for itself quickly. Machine capable of filling and closing 100-lb. bags at the rate of 15 per minute . . . needs one operator.

ALL BAGPAKERS• MAKE THIS FAMOUS "CUSHION STITCH"



TAPED CLOSURE IS MOISTURE RESISTANT—SIFT PROOF—INSECT PROOF

Taped closure is effected on models "A" and "DA"



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Are you using the most modern, economical method of packaging your product? Write for a BAGPAKER proposal and find out how our packaging plan can cut costs in your plant. A BAGPAK engineer will gladly discuss your packaging machinery and multiwall paper bag requirements... he'll show you the best methods of weighing, closing and handling.

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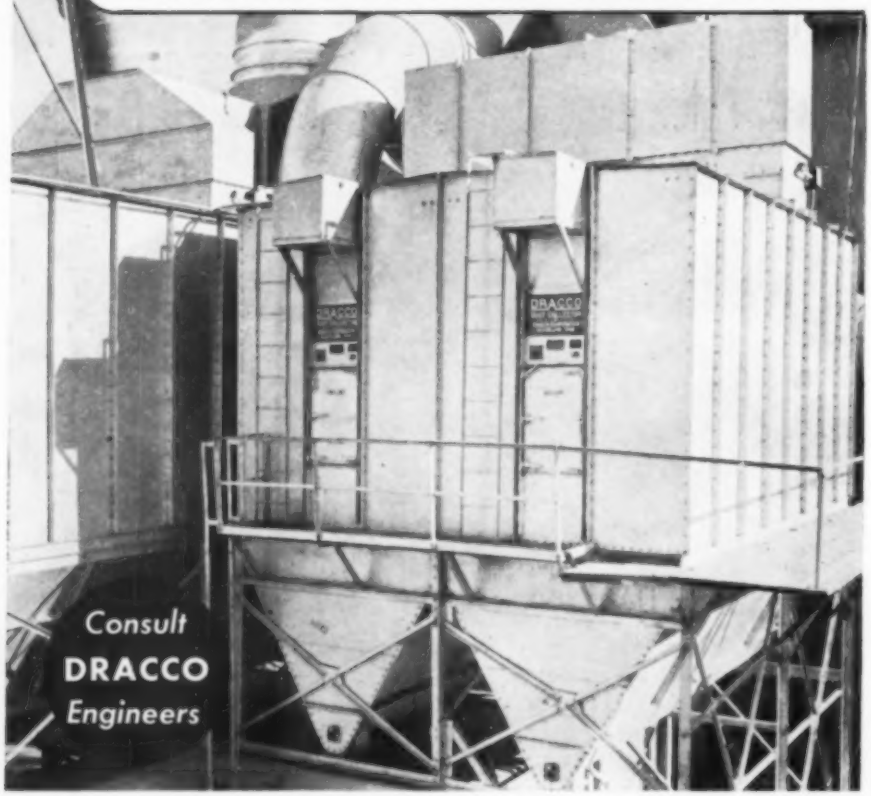
DUST CAUSES WASTE

DRACCO Dust Control SAVES MONEY



Dust, even in small quantities, causes WASTES in many ways — it is always destructive. Dust causes excess wear of bearings and other working parts necessitating more maintenance and reducing useful life of equipment. It is a health hazard that should be eliminated. The installation of DRACCO Dust Control, in thousands of plants, has always resulted in greater efficiency. Why not consult DRACCO Engineers about your dust problem. They have over 30 years experience in dust and fume control.

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PNEUMATIC CONVEYORS • METAL FABRICATION

ing, solution or latex coating. These products include coated paper and fabrics, thin films for curtains or raincoats, and thicker sheeting for upholstery, handbags and shoes.

63. Leather Dressing

DEVELOPED during the war to prevent damage to shoes used by the Armed Forces in the South Pacific, Dewatex leather dressing, made by Dewatex Manufacturing Corp., was used to waterproof, protect and preserve all types of leather goods and accessories. Now being marketed for consumer use through retail outlets, this material is creamlike in consistency and is available in tubes. One application is said to last an entire season and will protect the treated leather against rain, snow and atmospheric conditions.

64. Enamel Finish

A LINE of enamels that bake or air-dry to an aluminum-like finish have recently been announced by Maas & Waldstein Co., Newark, N. J. With a brand name of Britelume, these enamels were developed for use on metal products.

65. Synthetic Coating

DEVELOPED to protect metal and concrete from mineral acids and solvents, Vinaline, a plasticized synthetic coating has been recently announced by the Carboline, 502 N. Taylor, St. Louis 8, Mo. It is effective at temperatures from minus 40 to plus 162 deg. F., and is a specific coating for protection against sodium hypochloride and caustic soda. In this temperature range, Vinaline is claimed to be resistant to all concentrations of sulphuric acid up to 80 percent, nitric acid up to 35 percent, hydrochloric acid up to 35 percent, sodium hypochloride up to 10 percent, and caustic soda up to 25 percent. At temperatures under 100 deg. F., it has shown good resistance to 93 percent sulphuric acid, 65 percent nitric acid, and 50 percent caustic. Tests have shown that this coating has good adhesion to metal and concrete. Suggested uses for this new material are for protection of cast iron pump bases, concrete foundations, instrument panels, process and utility piping, exterior surface of tanks, structural steel supports, concrete foundations and conduits (at point of floor emergence). One Vinaline prime coat and two finish coats are sufficient to provide protection for twelve to eighteen months. Five years of protection are claimed to result from one prime coat and four finish coats.

CHEMICAL ENGINEERING NEWS

Richard F. Warren, ASSISTANT EDITOR

Hanford Atomic Energy Plant To Be Expanded

ALTHOUGH no details of design, construction or operation will be made public, a large expansion program is now planned for the Hanford Engineer Works, Richland, Wash., according to an official announcement. Stemming from research performed at the Argonne National Laboratories, Chicago, subsequent to construction of the present Hanford plutonium units, new chemical processing plants will constitute a major portion of the project. Design and construction work on these new processes for the production and purification of fissionable material, although not yet fully developed, will be under the direction of General Electric Co., which holds the prime contract.

Other work in the manufacturing areas will be based on operation studies begun by the DuPont Co., wartime operator. New research facilities, improvements to production units and expansion of housing and other community facilities are also scheduled. Opinion of competent observers is that the expansion program will be vast and in magnitude may even approach that of the original Hanford project.

Shell Expands Synthetic Ammonia Output

ANOTHER step in the expansion of synthetic ammonia production by Shell Chemical Corp. at Shell Point, near Pittsburg, Calif., was announced in July by J. Oostermeyer, president of the company. The new expansion will increase capacity about 50 percent over present production. Equipment for the increased capacity is scheduled to be in service in about a year. Only recently completed was an expansion program that doubled the plant's prewar capacity for manufacturing ammonia and ammonium sulphate.

In operation since 1931, the Shell synthetic ammonia plant is by far the largest producer of this chemical in the West and supplies a major portion of the nitrogen used in Western agriculture and industry. Ammonia is widely used as a fertilizer in the area either by application to irrigation water or by injection directly into the soil.

Pacific Chemical Exposition To Feature Conferences

AN outstanding feature of the first Pacific Chemical Exposition, to be held in San Francisco's Civic Auditorium during October 21-25, is a series of technical and economic papers known as the Pacific Industrial Conferences. These conferences will be sponsored by some nine societies or local groups and will stress all phases of the Western chemical, chemical equipment and process industries of interest to management, technical personnel and economists. Most of the societies will present full-day programs, and outstanding speakers from all over the nation will be present.

Together with the Exposition, which will feature exhibits of chemical or related products and process equipment, the Industrial Conferences are already being hailed as developing into the largest and most comprehensive opportunity ever presented for exchange of ideas and know-how on the chemical and related industries of the West. All persons registering at the Exhibition are invited to attend any and all programs presented by the participating groups.

Staley Manufacturing Has Modernization Program

EMBARKING on a modernization program, the A. E. Staley Mfg. Co. of Decatur, Ill., will spend $10,835,000 in increasing the efficiency of its plants. The work involves improvements in the present steep house, complete revamping of the mill house, elimination of table house operations and modernizing of the corn oil house. The process for producing modified starches, particularly for the paper and textile industries, will be streamlined and increased somewhat in capacity. Engi-

Top management and department heads of Wyandotte Chemicals Corp. recently held a week's conference with the sales force of the Michigan Alkali division at St. Clair, Mich. Sales and distribution policies were discussed with emphasis on the "completion time table" of the company's $25 million expansion program. Shown above are the sales representatives and district managers of the Michigan Alkali division. At the banquet table left to right are: Carter B. Robinson, vice president in charge of sales, J. B. Ford division; Ford Ballantyne, Jr., assistant vice president; George W. Schwarz, controller; William F. Torrey, executive vice president; S. D. Kirkpatrick, editor *Chemical Engineering*; Bert Cremers, vice president in charge of sales, Michigan Alkali division; Emory M. Ford, president, Wyandotte Chemicals Corp.; Stephen T. Orr, vice president in charge of production; and John Shallcross, assistant vice president

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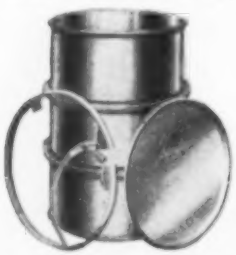

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METAL BARRELS AND DRUMS

neering work on new facilities which will make possible a 50 percent increase in the corn grind, to 75,000 bushels daily, is continuing.

The company also has an expansion program in mind but has announced that the modernizing program must be completed before expansion can be undertaken and this together with current high construction cost has deferred any commitment on expansion.

Wyandotte Reports Progress On Expansion Program

A PROGRESS report on the $25,000,000 Wyandotte Chemical Corp. expansion program has been made by W. F. Torrey, executive vice president. The new calcium carbonate

CONVENTION CALENDAR

Technical Association of the Pulp and Paper Industry, fundamental research meeting, Appleton, Wis., September 3-5.

Instrument Society of America, second annual instrument conference and exhibit, Stevens Hotel, Chicago, Ill., September 8-12.

American Chemical Society, 112th national meeting, New York, September 15-19.

National Petroleum Association, 45th annual meeting, Hotel Traymore, Atlantic City, N. J., September 17-19.

Drug, Chemical and Allied Trades Section, New York Board of Trade, 57th annual meeting, Shawnee Inn, Shawnee-on-Delaware, Pa., September 25-26.

American Institute of Chemical Engineers, regional meeting, Hotel Statler, Buffalo, N. Y., September 29-October 1.

Packaging Machinery Manufacturers Institute, 15th annual meeting, Hotel Sheraton, Springfield, Mass., October 6-7.

Electrochemical Society, fall congress, Copley-Plaza Hotel, Boston, Mass., October 15-18.

National Lubricating Grease Institute, annual convention, Edgewater Beach Hotel, Chicago, Ill., October 16-18.

American Society for Metals, National Metal Exposition, International Amphitheater, Chicago, Ill., October 18-24.

Pacific chemical exposition, Civic Auditorium, San Francisco, Calif., October 21-25.

Exposition of Chemical Industries, 21st exposition, Grand Central Palace, New York, N. Y., December 1-6.

American Society of Heating & Ventilating Engineers, eighth international heating and ventilating exposition, Grand Central Palace, New York, February 2-6 1948.

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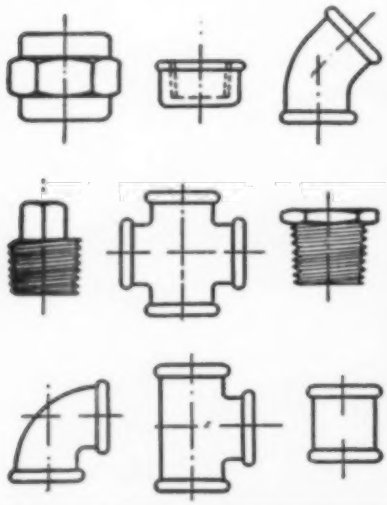

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Wyandotte expansion includes new glycol plant (left) and new lime kilns (right). The former is scheduled for production the last part of this year; the latter, sometime next year

unit has been in complete operation since April 1947. The latest expected operating dates for the other new plants are: glycol, September, 1947; synthetic detergent, November 1947; power plant addition, December 1947; chlorine, Jan. 1948; light ash, March 1948; dense ash, June 1948.

Oil Companies Create New Fellowships at Oklahoma

ESTABLISHMENT of new fellowships in the college of engineering, University of Oklahoma, by two oil companies has been announced by W. H. Carson, dean of the college. A $1,000

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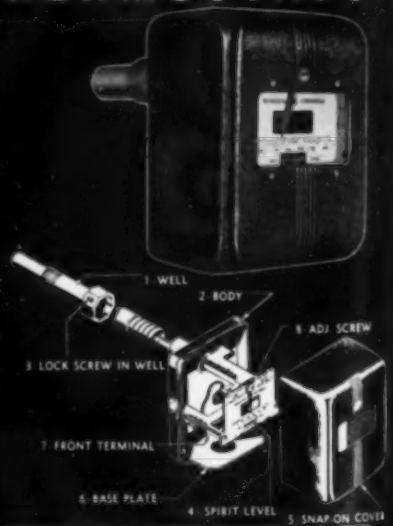

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Fig. 631

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Aerial view of American Viscose Corp.'s plant at Front Royal, Va. which is now the world's largest rayon producing unit. Rayon tire yarn production was tripled and rayon staple production increased 50 percent by additions covering ten acres of ground and modernization of processes just completed at a cost of $30,000,000. For this expansion The Rust Engineering Co., Pittsburgh, designed and built mill buildings and rebuilt rayon staple spinning machines

grant has been made by Stanolind Oil & Gas Co. for the academic year beginning Sept. 1, with an option for renewal. This fellowship pertains to students who are candidates for the master's degree in petroleum engineering. The Shell Oil Co. has established a similar fellowship of $1,200.

Monsanto Building Atomic Research Unit in Ohio

APPEARANCE and scope of the nation's newest atomic energy facility was shown in July when the Atomic Energy Commission and Monsanto Chemical Co. released an architect's drawing showing how the installation at Miamisburg, Ohio, will appear upon completion early next year. Monsanto will operate the new laboratory for AEC, and will engage in the investigation of basic chemical problems in the field of atomic energy.

The facility will be called Unit No. 5 of Monsanto's central research department. Site for the installation was selected by the Manhattan District in

NOW CONVEYCO offers the finest development in automatic weigh batching — an Electronic Controlled Weigh Unit, which can be adapted to any weigh batching equipment. No complicated mechanisms. This Conveyco Unit is designed around standard electrical equipment, using a dial scale with *single indicator* and *one photo electric cell.*

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VESSEL NEWS

A. O. SMITH Corporation

New York 17 • Philadelphia 5 • Pittsburgh 19 • Atlanta 3
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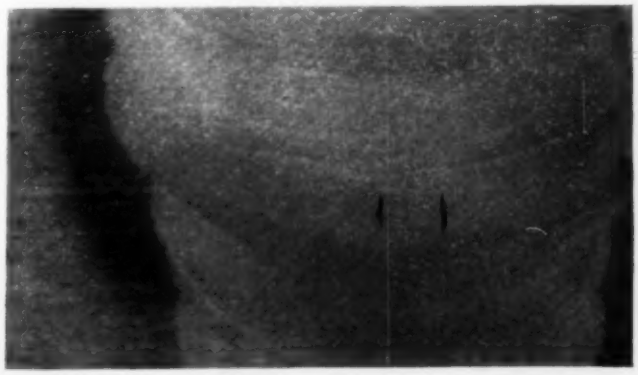
International Division: Milwaukee 1

NEW VESSEL DIVISION HEADQUARTERS. Paint is scarcely dry on new air-conditioned building (above, center) which puts administration, sales, engineering, drafting, production control, and inspection immediately adjacent to the A. O. Smith vessel shops, Milwaukee.

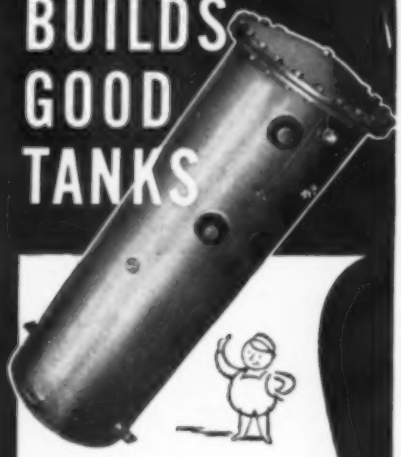
TOO BIG FOR THROUGH RAIL SHIPMENT, four 16′ x 90′ coke drums were moved to location on Lake Michigan's biggest barges, two vessels to a barge. To get the vessels from A. O. Smith shops to the Lake Shore dock, special arrangements had to be made on five miles of railway track.



THESE SULFUR CRACKS are dangerous in welded heavy sections. A. O. Smith metallurgists have figured out a way to avoid them by controlling the residual sulfur in welding wire.

ORCHIDS to the production-control crew, headed by a twenty-five-year A. O. Smith man, who were responsible for keeping to a schedule the simultaneous production of four large 16′ x 90′ alloy-lined coke drums, a feat few shops in the world could accomplish.

LITTLEFORD BUILDS GOOD TANKS



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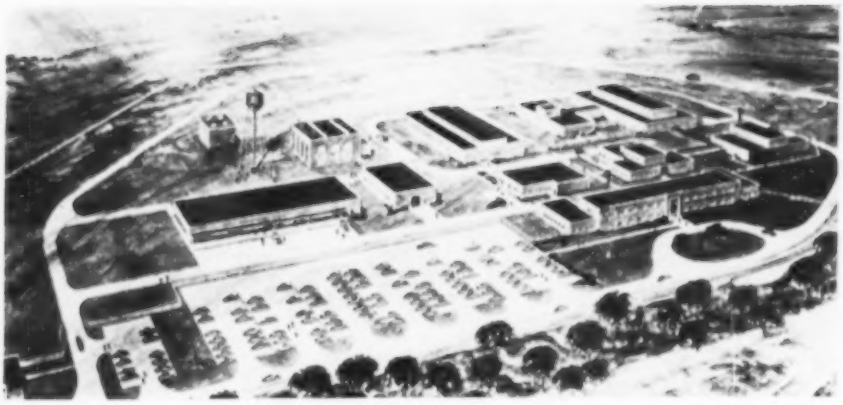


Architect's sketch of Miamisburg atomic energy research unit

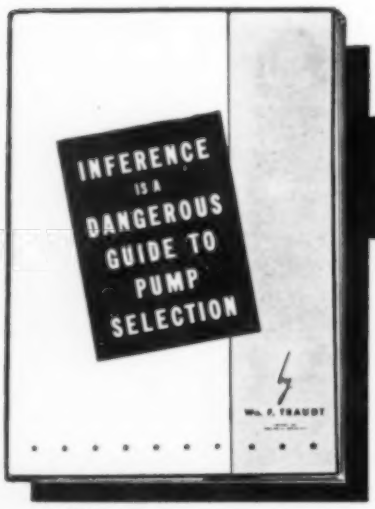
cooperation with Monsanto. Construction of the project was authorized last September. Work at the site began in December.

The Laboratory will conduct fundamental chemical studies in the nuclear sciences, and will develop and test processes, procedures and techniques which will be applied to the operation of the nation's atomic energy program. A portion of the facility will be underground in order to obtain conditions necessary to certain types of laboratory work.

Working closely with Monsanto in the planning for the new operation is Kenneth A. Dunbar, area manager for the AEC. George C. Gabler is project manager in charge of construction for Monsanto. Dr. Malcolm M. Haring will be laboratory director.

ACS National Meeting to be Held in September

RECENT advances in nuclear chemistry, food protection, petroleum, and plastics will be reported at the 112th national meeting of the American Chemical Society, which will be held in New York from September 15 to 19. Improved methods of purifying water supplies, new developments in fluorine chemistry, and progress in the



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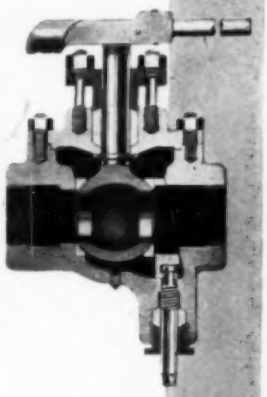
American industry flows through fairbanks valves

HUB END GATE VALVE
(Fig. — 0431)

. . . 175 lbs. cold water working pressure — non-shock. A non-rising stem gate valve designed for use with Indicator Posts on lines below ground or floor level. Body of semi-steel with high tensile strength, reinforced at all points of strain. Stem of heavy bronze with Acme threads for additional lifting strength and ease of operation. All parts in contact with stem are bronze or bronze lined to prevent corrosion, reduce friction. Sizes 4" through 14".

IMPROVED "SPHERO" BALL VALVES
(Fig. — 0850)

. . . 250 lbs. steam working pressure; 500 lbs. cold water, oil or gas pressure — non-shock. A quick opening valve with full flow. ¼ turn fully controls valve. Eliminates all easily corroded, threaded parts in line of flow . . . offers less resistance to flow. Cleaning of working parts can be accomplished without removing valve from line. Sizes ½" through 8".



ASBESTOS PACKED COCK
(Fig. — 0805)

. . . 125 lbs. steam working pressure; 200 lbs. cold water, oil or gas pressure — non-shock. Grooved, asbestos packed plug cock for boiler blow-off service or controlling the flow of certain acids. Body plug and gland are semi-steel with great strength. Plug is barffed (protected against rust by a special process). Asbestos groove packing is vulcanized . . . provides a smooth, non-galling bearing for the plug. Sizes ⅛" through 6".

GLOBE VALVE
(Fig. — 0110)

. . . 250 lbs. steam working pressure; 500 lbs. cold water, oil or gas pressure — non-shock. Extremely rugged iron body, bronze mounted globe valve of the regrinding type. Has ample safety factor to withstand the stresses and strains of high pressure. Bronze stems with Acme threads are of generous proportions for strength and ease of operation. Without removing valve from line, seat and disc may be reground when necessary. Sizes 2" through 12".

IRON BODY GATE VALVE
(Fig. — 0405)

. . . 125 lbs. steam; 200 lbs. cold water, oil or gas (pressures vary with sizes). Designed for general service on steam, water, gas or oil where unobstructed full flow is desired. Strong construction with reinforcing where required to give extra strength, long, trouble-free life. Bronze mounted, outside screw and yoke, solid wedge, taper seat. Valves may be repacked under pressure when wide open. Sizes 2" through 24".

"For outdoor fire hazards like this, a wheeled extinguisher is a must!"

Inside your plant, but *outside* its building walls, there may be a fire-danger spot that's beyond the range of your present extinguishing equipment. Outdoor transformers, for example. Or flammable liquid storage tanks.

Why not discuss these hard-to-reach spots with a Kidde representative? Chances are, you'll find they can be effectively protected with a *Kidde* Wheeled Extinguisher.

It covers ground fast, maneuvers easily at the scene of action. Discharging dry, clean carbon dioxide, it smothers blazes fast . . . has ample capacity for protecting serious hazards.

And while you're talking to the Kidde representative, discuss your special indoor hazards with him too. His fire protection knowledge may be helpful to you in many ways—and it's always at your disposal.

Walter Kidde & Company, Inc., 828 Main St., Belleville 9, New Jersey

The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

Kidde

FIRE PROTECTION HEADQUARTERS

production of synthesis gas are among other subjects which will be discussed in several hundred technical papers at sessions sponsored by the eighteen professional divisions of the society.

The Priestley Medal will be presented to Prof. Warren K. Lewis of Massachusetts Institute of Technology

Warren K. Lewis

at a general meeting of the society at the Manhattan Center on September 15. He will speak on "The Kinetics of the Reaction of Steam and Carbon Dioxide with Carbon."

Prof. Glenn T. Seaborg of the University of California, co-discoverer of plutonium and a member of the general advisory committee of the United States Atomic Energy Commission, will address the meeting on "Nuclear Transformations in the New High Energy Reaches." He will receive the $1,000 ACS Award in Pure Chemistry, given by Alpha Chi Sigma, national chemical fraternity, for his achievements in nuclear chemistry.

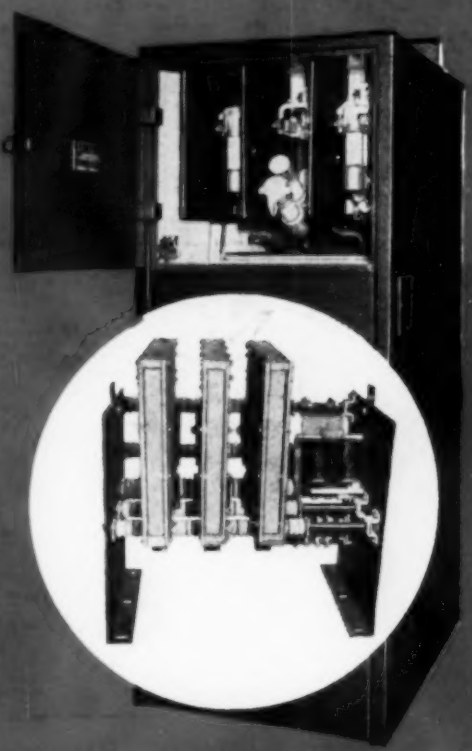
Dr. W. Albert Noyes, Jr., in his presidential address will discuss "The Mechanism of Photochemical Reaction." General headquarters of the meeting will be the Hotel Pennsylvania. The paint-varnish, and plastics divisions will meet at the Hotel New Yorker, the rubber division at the Hotel Commodore, and the petroleum division at the Waldorf-Astoria.

Monsanto Lets Contracts For Texas City Plant

CONTRACTS for reconstruction of part of the Monsanto chemical plant at Texas City, Texas, which was destroyed last April, has been let to the W. S. Bellows Co. of Houston and the Leonard Construction Co. of Chicago. The Bellows company will do the building work and the Leonard company will install chemical process equipment and do piping and mechanical work. It is

QUICK AS A FLASH!

LIMITAMP CONTROL GIVES SURE, SHORT-CIRCUIT PROTECTION



In less than *one-quarter* cycle, EJ-2 fuses in Limitamp control can cut off a rise in current from a short, and clear it in one-half cycle—long before the short has time to harm the contactor or motor. Your plant's power system needs this prompt handling of fault currents, and you will avoid the risk of costly shutdowns that can result from one, mad short circuit.

A STARTER AND PROTECTOR IN ONE CABINET

G-E Limitamp control consists of an airbreak contactor (the motor starter), and EJ-2 fuses (the short-circuit device). They are mounted in separate compartments of one, all-steel cabinet.

Airbreak contactors are specially designed for hard duty. Operating experience has proved they furnish reliable, low-cost service with only routine maintenance.

Because they operate in air, they eliminate the problem of handling oil. And tip life of airbreak contactors is many times that of comparable oil-immersed tips.

You can depend on EJ-2 fuses for sure, short-circuit protection. They are "fail-safe" devices. There is nothing about them to wear. They are easy to replace.

OVERLOAD AND UNDERVOLTAGE PROTECTION

Isothermic overload relays, accurately calibrated against actual motor characteristics, guard the motor against overheating from sustained loads or single phasing.

FACTORY-ASSEMBLED CONTROL

Factory-assembled in one cabinet, Limitamp is easy to install, easy to co-ordinate with other control, saves space, and improves the appearance of your plant.

Limitamp control is furnished as a single unit, in groups, or in special enclosures for special operating conditions.

The Trend is to AIR

G-E LIMITAMP . . . THE FIRST HIGH-VOLTAGE CONTROLLER WITH AIRBREAK CONTACTORS

GENERAL ELECTRIC

Apparatus Department,
General Electric Company, Section E676-250
Schenectady 5, New York

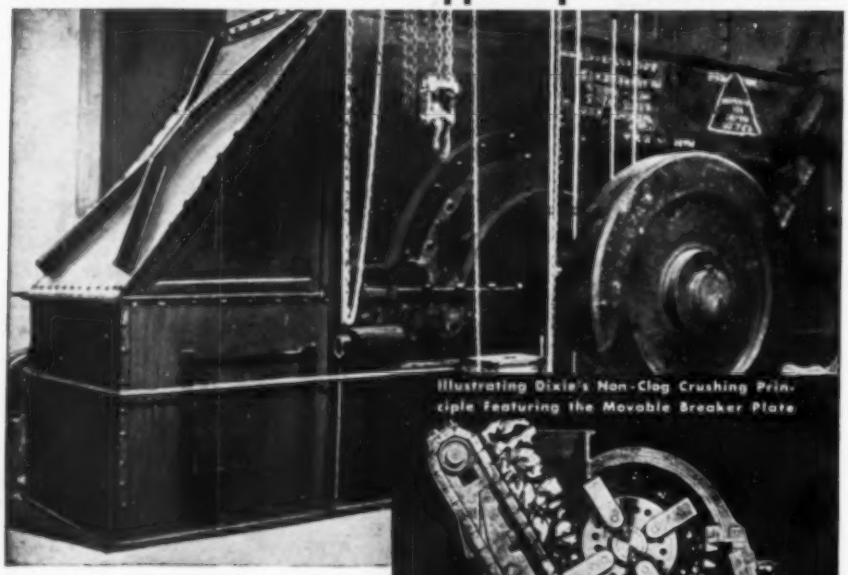
Please send me Bulletin GEA-4247 on Limitamp control.

Name.....

Company.....

Address.....

How the CUBAN PORTLAND CEMENT CO. broke a bottleneck...stepped up PRODUCTION



Illustrating Dixie's Non-Clog Crushing Principle Featuring the Movable Breaker Plate

● Dixie Non-Clog Hammermill in operation in plant of the Cuban Portland Cement Co. Incorporating distinct time, labor and money-saving principles, The Dixie Method carries the material right to the hammer points . . . eliminating need for extra men at feed hopper.

Down in the bay of Mariel, some 20 miles out of Havana City, the semi-tropical climate accounts for 50 to 70 inches of rainfall per year. For the Cuban Portland Cement Co., this factor . . . combined with the soft, wet material generally encountered in quarrying operations . . . was seriously curtailing production.

It was not until the installation of a Dixie Non-Clog Hammermill, equipped with the patented Movable Breaker Plate, that delays due to "Choke-Ups" were reduced and a new 'high' in continuous production was established. Since then, this Dixie Hammermill has worked under the worst possible conditions . . . operating at times for a whole week on raw material which was "nothing but a mass of plastic, sticky, water-sodden mud."

This is only one of the numerous instances where a Dixie Hammermill has been instrumental in keeping production at a *high* peak . . . yet at a *low* cost.

Let an experienced Dixie engineer show you how the Dixie Hammermill can increase production and profits in *your* crushing operation.

Send for new, illustrated bulletin . . .
"More Efficient Crushing of Raw Materials"

DIXIE
MACHINERY MANUFACTURING CO.

4172 Goodfellow Ave. St. Louis 20, Mo.
104 Pearl St. New York, N. Y.
1023 Market St. Oakland 7, Calif

estimated that the building contract will run a little more than $1,000,000 and the equipment and mechanical installations will approximate $5,000,000. Rebuilding of the remainder of the plant will be started when this work is substantially complete and the plant is again in operation.

Large Pennsalt West Coast Unit Opens in Oregon

THE expansion program of Pennsylvania Salt Mfg. Co. of Washington, completed June 21 at Portland, Ore., consists of a complete chlorine and caustic soda plant, all under one roof with the exception of liquefaction; a separate technical DDT plant; storage installations for caustic soda; a new salt pad, and additions to the drum shop and boiler plant. Solar evaporated sea salt is brought in from California by ship, unloaded and transported by truck to the new salt storage pad capable of holding 8,000 tons. From this point a saturated brine is pumped to the purification department where chemicals are added to remove traces of calcium and magnesium. The purified brine is fed constantly into 1,200 Gibbs type electrolytic chlorine cells.

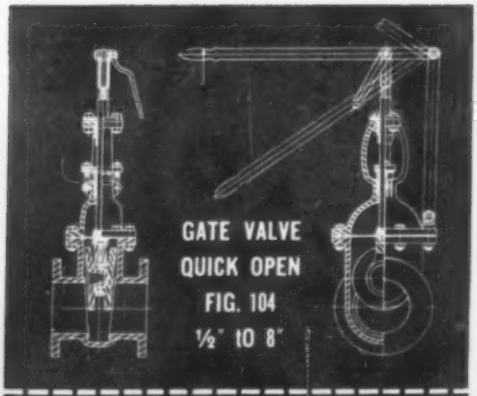
The cells are divided into twelve series of 100 cells each. Cells are insulated from the concrete floor by tile insulators. All brine, steam, air and gas mains are in a tunnel under one end of the cell room permitting easy access for maintenance and observance. The mercury rectifier building is at one end of the cell room and contains four 1,750-kw. General Electric mercury-arc rectifiers which receive a.c. power at 13,800 volts and convert it to d.c. power at 365 volts which is fed to the cell series. Constant load factor is maintained by an automatic control which assures constant current flow to the cells regardless of fluctuations on the incoming power lines.

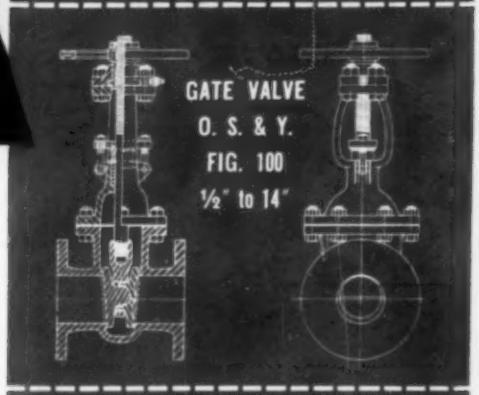
Liquor from the cells containing approximately 10 percent caustic soda and 15 percent salt is fed to a triple-effect, countercurrent, vacuum-type, forced circulation Zaremba evaporator where the caustic content is concentrated to 50 percent. During this process the salt content drops from 15 percent to slightly more than 2 percent. Salt removed from the evaporator is fed to Sharples centrifuges which separate the solid salt crystals from the caustic liquor. Caustic liquor is returned to the evaporator system and the salt, dissolved in water forming a saturated brine, is returned to the cell room.

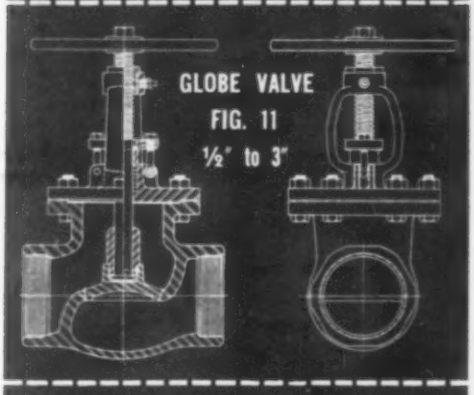
All parts of the evaporator equipment coming in contact with hot caustic liquor are either solid nickel or nickel-clad steel. This includes the

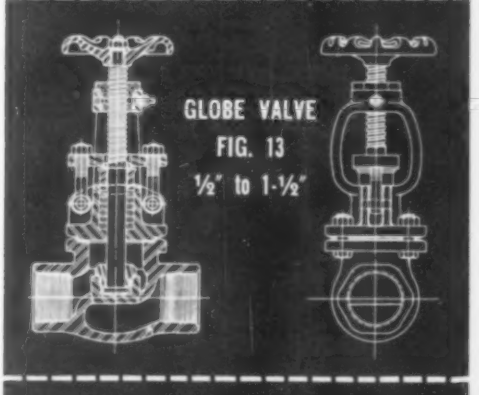
Now Available from Stock

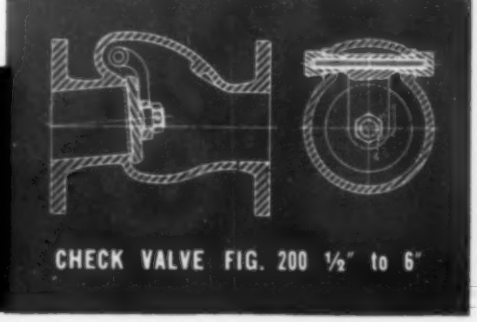
COOPER Certified Stainless STEEL Valves and Fittings





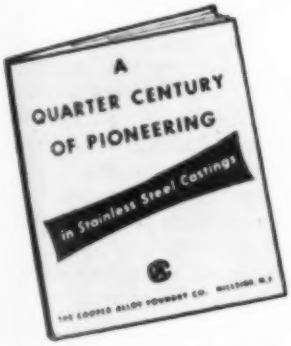






Backed by 25 years of Stainless Steel "know how", each Cooper valve or fitting is "Certified" to do its job efficiently . . . for Cooper registers the analysis of each heat, and stamps each casting with its heat number. When desired, a certificate of the analysis and heat number is issued which applies to all Stainless Steel parts which come in contact with the liquid being handled. Each valve or fitting rigidly meets the specifications of the job.

COOPER Stainless Steel Valves and Fittings are sold through the largest Stainless Steel distributors in the country. Check with your local distributor.



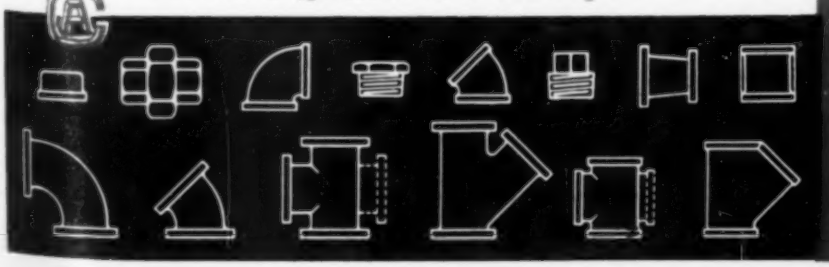
Just off the Press!

The behind-the-scenes story of Cooper and 25 years of pioneering in Stainless Steel Castings . . . taking you on a tour of Cooper's facilities and detailing the production methods employed in Stainless Steel Castings. We will be glad to forward a copy upon request.

The COOPER ALLOY FOUNDRY CO.

HILLSIDE, N. J.

Specialists in Corrosion Resisting Stainless Steel
. . . For a Quarter of a Century . . .



3 STEPS TO PROFITS for CHEMICAL PROCESSING PLANTS

Automatic proportioner . . . for two or more liquids . . . with patented, precision volumetric meter control. Records quantity of each ingredient as well as finished product. Eliminates costly batch mixing . . . reduces labor, handling costs, storage space and capital investment.
Automatic unit for filling containers in predetermined quantities from one pint to nine quarts. Temperature control and specific gravity adjustment.
Bowser Industrial Xacto Meters accurately measure liquids ranging from acids to wood oil. Gray cast iron, brass and bronze or stainless steel construction.
BOWSER
SINCE 1885

. . . SHORT-CUTS TO OPERATING ECONOMY

These Bowser units have led the way to lower processing costs in many plants by eliminating shortages, streamlining production and guaranteeing uniformity of product.

A Bowser man will be glad to check your requirements and make recommendations.
No obligation . . . just write BOWSER, INC.,
1367 Creighton Avenue, Fort Wayne 2, Indiana

Liquid Control Specialists Since 1885

evaporator bodies, piping and pumps.

Chlorine gas from the cells is conducted from the cell room to the chlorine liquefaction building by means of an 18-in. ceramic pipe. The gas is cooled in spray type ceramic coolers to 60 deg. F. to remove all moisture possible before entering the drying towers where sulphuric acid is used to remove the last trace of moisture. The gas is then compressed to 25 psi. by means of a Nash Hytor compressor. It is then cooled in two stages to −45 deg. F. and the resulting liquid chlorine flows into storage tanks to be loaded by means of pressure differential into 100 and 150-lb. cylinders, one-ton containers, or tank cars.

Fifty percent liquid caustic soda from the evaporation department is stored in 14 22,000-gal. steel tanks, and one 100,000-gal. steel tank. From these tanks it is loaded into tank cars for shipment.

The DDT plant is housed in a two-story, concrete, steel and tile building 40 by 80 ft. Outside storage is provided for raw materials which include sulphuric acid, alcohol and monochlor benzene. Chlorine gas, air and steam are piped to the plant from the chlorate and chlorine operations.

Lignin Conference To Be Held in New Haven

THE Northeastern Wood Utilization Council, New Haven, Conn., has announced its forthcoming conference on lignin chemistry and applications. It will be held in cooperation with Yale University and will be held in the Sterling Chemistry Laboratories on September 19. Provisional program includes papers by Dr. F. E. Brauns, Institute of Paper Chemistry, who will discuss proven chemistry of lignin; Dr. E. Farber, Timber Engineering Co., who will review recent German work; Dr. Robert S. Aries, Polytechnic Institute of Brooklyn, who will bring up to date work done on lignin as a fertilizer.

There will be a panel discussion on lignin applications to include Dr. G. H. Tomlinson, Howard Smith Paper Mills, who will talk on soda lignin; Dr. Bjarne Johnson, Hammermill Paper Co., on sulphite lignin; and Dr. Arthur Pollack, West Virginia Pulp & Paper Co., on sulphate pulping.

Large Newsprint Mill Planned on Coosa

MANUFACTURE of newsprint in Alabama on a large scale is promised on the property that was formerly part of Alabama Arsenal. This arsenal was on the Coosa River near Childersberg, Alabama. The large steam plant on

Preview of PRODUCTS

To be featured at 2nd Annual Instrument Show Chicago, Ill., Sept. 8-12.
See them at the K booth — No. 120

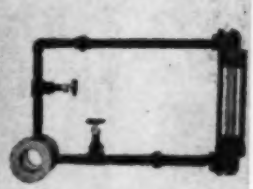
UNIVERSAL ROTAMETER—Accurate, simple, and convenient to use, this rotameter is ideally suited for the vast majority of rate-of-flow metering applications.

ELECTRONIC ALARM ROTAMETER—With no moving parts in the alarm device, this alarm is very sensitive and is particularly adapted to the smallest rotameters and the lowest rates of flow.

ELECTRONIC RECORDING ROTAMETER—An induction transmitter on one of several standard K Rotameters and a Foxboro electronic *Dynalog recorder provide a continuous permanent record of flow conditions. Instantaneous response to change of rate of flow, rugged power, positive linear motion, direct linkage with no gears, and long life are features of this system.

ARMORED ROTAMETER—Used for metering fluids which are extremely hazardous or under abnormally high pressure, the metering tube is protected by bolted steel cover plates with boiler gauge glass windows for reading.

SPECIFIC GRAVITY INDICATOR—This adaption of an K Universal Rotameter is a simple dependable device which provides continuous indication of specific gravity by means of a standard hydrometer.



BY-PASS ROTAMETER—This rotameter is easily inserted into existing pipe systems, and is sometimes more economical than other types. Since the flow is read by by-passing a portion of the main flow, a smaller rotameter can be used. It is especially well suited for reading flow in pipes over 4" in diameter.

LINE-O-LITE ROTOR IN OPAQUE FLUID DEMONSTRATOR—A demonstration setup shows the effectiveness and ease of reading a Line-O-Lite rotor. Specially useful in making clear, precise readings of opaque fluids, a rotor, with a thin disk of light-transmitting plastic or glass incorporated, clearly delineates readings on the reference scale.

FLOW INDICATORS—Either the rotary or flapper type Flow Indicator provides opportunity to observe flow and condition of any fluid or gas sufficiently translucent to permit visual indication.

PAY US A VISIT AT THE SHOW.

*Reg. U. S. Patent Off. The Foxboro Co.

SCHUTTE AND KOERTING COMPANY

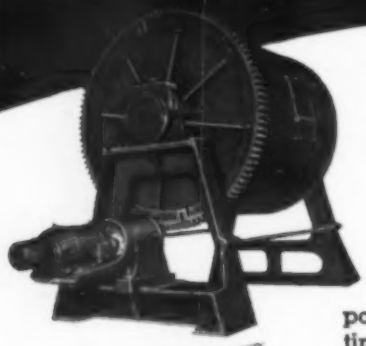
Manufacturing Engineers

1190 THOMPSON STREET, PHILADELPHIA 22, PA.

Jet Apparatus • Condensers and Vacuum Pumps • Heat Transfer Equipment • Valves • Rotameters • Flow Indicators • Gear Pumps • Strainers • Oil Burning Equipment • Spray Nozzles and Atomizers • Radiafin Tubes

Grinding Wet or Dry Materials in Any Quantity

Get Finer Mesh Better Dispersion at Lowest Cost



Select any size or style of Abbé Pebble or Ball Mill to meet your specific requirements in grinding, pulverizing or reducing—at any temperature, vacuum or pressure—and you get just about the best equipment for this unit operation.

Abbé Mills, batch or continuous tube type, provide greater grinding output per unit of space and power. They require a minimum of time and labor. They're built to produce and stand up in hard service.

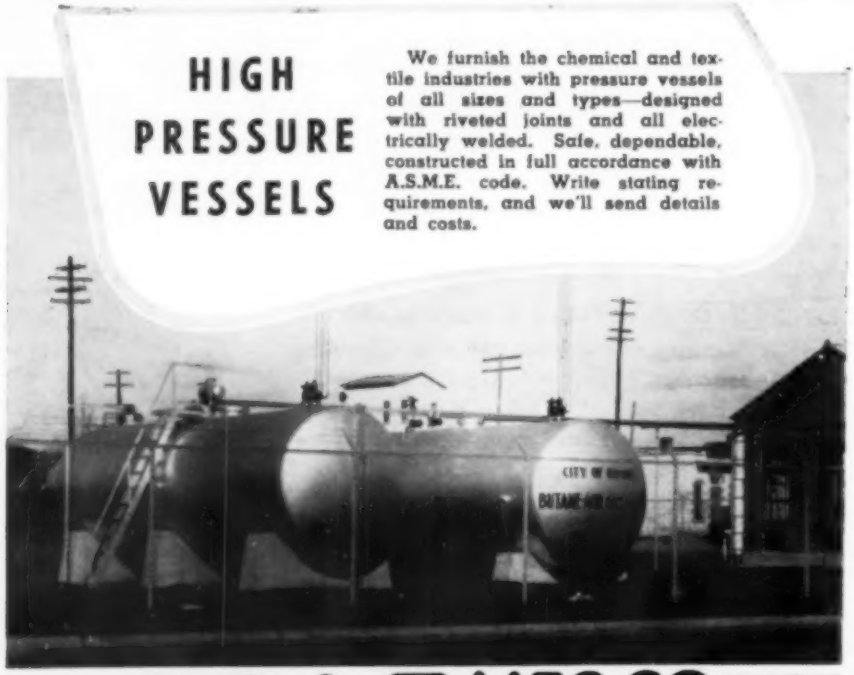
There's a type, size and drive of Abbé Mill for any quantity of material from 3 lbs. to 7 tons per batch, or for any continuous production rate. Catalog 55 on request.

ABBÉ ENGINEERING CO.
42 Church Street NEW YORK 7, N. Y.

ABBÉ PEBBLE MILLS · BALL MILLS

HIGH PRESSURE VESSELS

We furnish the chemical and textile industries with pressure vessels of all sizes and types—designed with riveted joints and all electrically welded. Safe, dependable, constructed in full accordance with A.S.M.E. code. Write stating requirements, and we'll send details and costs.



R.D. COLE MFG. CO. ESTABLISHED 1854
Newnan Ga.

that site has been leased for a long period of years and early beginning of plant construction is promised.

Kimberly-Clark will manage the enterprise for a group of Southern newspapers, members of Southern Newspaper Publishers Association. These backers of the project have contracted to take the entire output of newsprint, which will supply prospectively much less than half the needs of the subscribing members. No other commercial sales are expected. It is understood that Kimberly-Clark expects to carry on also other manufacturing operations at this site, making it an important Southern center of production for a number of its products.

Annual Chemical Show Coming To New York in December

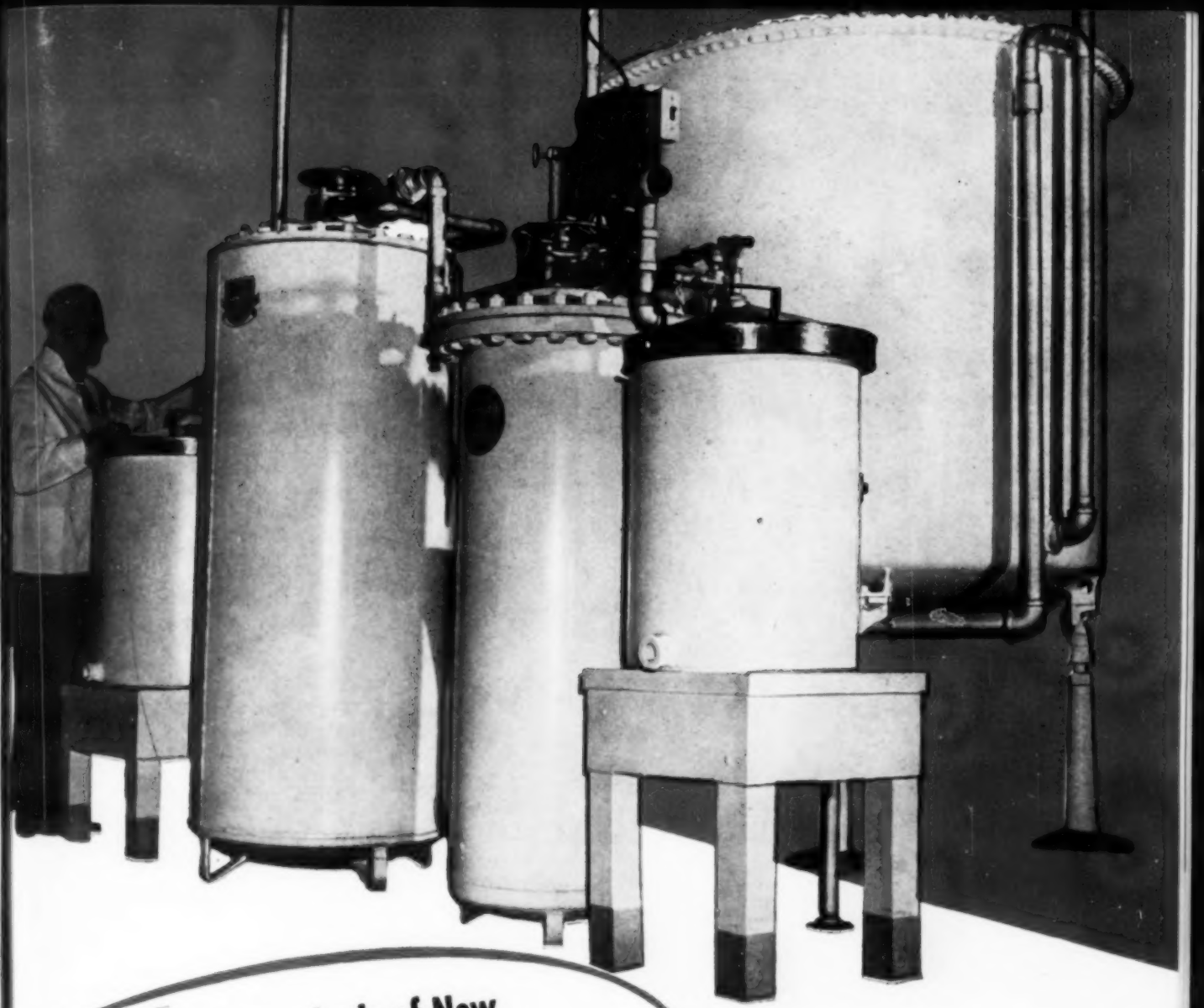
Widespread interest has developed in the 21st Exposition of Chemical Industries. Although the exposition will not be held until December 1 to 6, space reservations already assure the complete occupancy of four floors of Grand Central Palace, New York. There will be an increase in exhibits of chemicals. The display of processing equipment will be more comprehensive than usual. Raw and fabricated materials, standard mill units, such as valves and piping, shafting pulleys, belts, clutches and couplings, transmissions, conveyors, motors, pumps and others will be shown.

Only accredited visitors will be admitted to the exposition under the invitation and registration system of attendance control. Charles F. Roth is manager of the exposition.

U. S. Rubber To Take Over Operations of Texas Unit

Soon the United States Rubber Co. will undertake operation of the 45,000 ton synthetic rubber plant at Borger, Tex., and will relinquish operation of the synthetic rubber plant at Los Angeles, J. P. Coe, vice president and general manager of the Naugatuck Chemical and Synthetic Rubber divisions has announced. The Borger plant, built and operated for the government by B. F. Goodrich Co., is located in the panhandle of Texas adjacent to a butadiene plant operated by Phillips Petroleum Co.

Production of synthetic rubber latex will be continued at the Naugatuck, Conn., plant, and this plant also will continue to make a super processing GR-S, especially developed for wire insulation. Production of black masterbatch GR-S will be continued at the Institute, West Virginia, plant although, in line with the government's policy of curtailing synthetic rubber production, operations at Institute



One of hundreds of New
Permutit Demineralizers in use delivering...

LOW COST EQUIVALENT OF *DISTILLED WATER*

Are you using distilled water *sparingly* because of high cost? If so, you can cut costs *sharply* with this new kind of water!

Permutit Demineralized Water is suitable for most applications for which distilled water is satisfactory. But the cost of demineralized water is only a fraction of the cost of distillation! In some cases it is 95% cheaper than distilled!

Permutit's Demineralizing process is simply this: Zeo-Karb H, Permutit's acid-regenerated organic cation exchanger, removes metallic cations from the water, converting salts present into corresponding acids. These same acids are then removed from the water by De-acidite, a resin-type Anion exchanger. This simple, low-cost process may help you cut costs! Write Dept. CE6 for full information—The Permutit Company, 330 West 42nd Street, New York 18, N. Y., or Permutit Company of Canada, Ltd., Montreal.

Permutit

for 34 years

WATER CONDITIONING • ION EXCHANGERS • MATERIALS & EQUIPMENT • CHEMICALS

For High Capacity

Trentweld
Large Diameter
STAINLESS STEEL TUBE
keeps your costs in line
by the foot
by the year
by the dollar

IF you have an interest in holding what cash you can to near or below pre-war levels, then Trentweld engineers have facts and figures you will find worth checking against your particular problem. For example, the pictures above show only a few of the hundreds of tubes rolled for the new Champion Paper Mill at Houston, Texas. This tube is type 304 stainless, with a wall thickness of 0.078. **Diameter, is 10 in. and 12 in.** I. D. tube lengths 8 ft. and 12 ft. These specifications assure Champion of process lines with a future free from troublesome maintenance expense.

Trentweld tube ranges in size from ⅛" to 30", is available in wall thicknesses from about 0.002 to about 3/16". It may be rolled from many types of stainless steel or Inconel—whatever best meets the needs of the application. Without obligation address Dept. 10 or send for the Trentweld data bulletin.

TRENTWELD STAINLESS STEEL TUBES

General Office and Mill at
East Troy, Wisconsin

TRENT TUBE MFG. CO.

District Offices
New York, Chicago,

will be gradually reduced. Production of GR-S by the company, which reached a high of 161,945 tons in 1944 will be on the basis of about 60,000 tons a year by the end of 1947.

Management and supervising personnel for the Borger operation will be drawn from the plants now operated by the company at Los Angeles and Institute, West Va.

Graduate Course in Chemical Engineering Economy

THE graduate course "Chemical Engineering Economy" will again be offered during the first semester of the academic year 1947-48 at the Polytechnic Institute of Brooklyn, N. Y. It will consist of a fifteen lecture symposium given on Wednesday evenings from 8:00 to 10:00 P.M.

In the course, a basic treatment of the economic aspects of the chemical industries will be given with special reference to the study of actual problems encountered by the chemical engineer.

The course is under the direction of Dr. Robert S. Aries, consulting engineer and research associate at the Polytechnic Institute, assisted by a number of industrial specialists.

Industry Briefs

Offices of the Synthetic Organic Chemical Manufacturers Association of the United States are now located at 41 East 42nd St., New York 17, N. Y. Telephone number is unchanged at Murray Hill 2-8128.

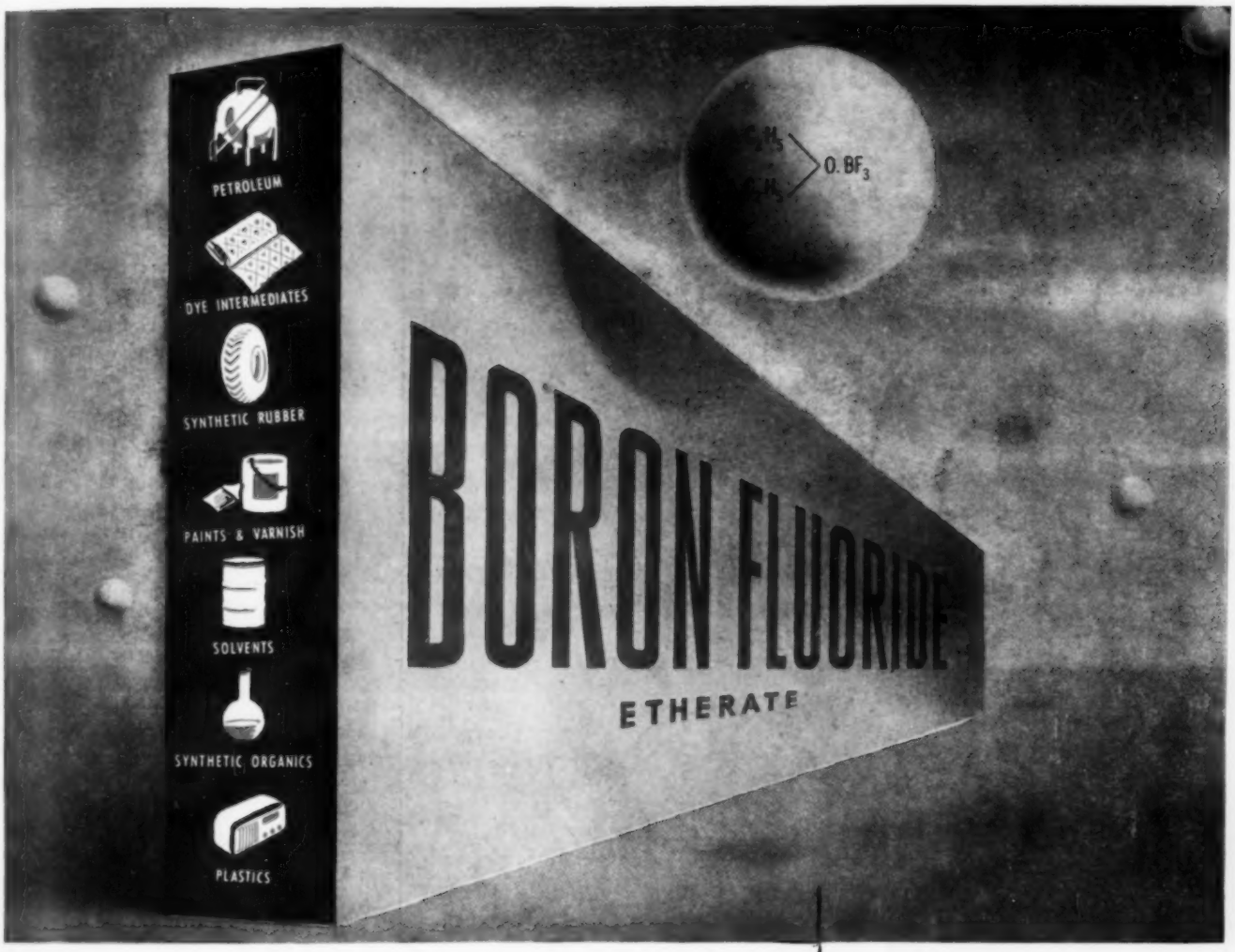
International Minerals & Chemical Corp. has elected J. P. Margeson, Jr., executive vice president. He will act for Louis Ware, president, in his absence. Mr. Ware is on a tour of Europe to confer with leading users of phosphate rock, to assist in increasing food production by means of greater use of fertilizers.

Standard Oil Development Co. has elected E. V. Murphree president to succeed R. P. Russell, who has resigned to become technical consultant to International Basic Economy Corp.

General Aniline & Film Corp. has elected Jack Frye president to succeed George W. Burpee who has returned to his engineering firm, Coverdale & Colpitts.

Correction:

IN THE June issue of *Chemical Engineering*, the statement ". . . oil production in 1946 in the six-state American tung belt along the Gulf Coast was 47,300 tons." was in error as the 47,300 tons referred to production of tung nuts and not oil.



Do You need this

VERSATILE NEW CATALYST?

From petroleum to plastics ...synthetic organics to solvents, Boron Fluoride Etherate is a valuable catalytic chemical with a far-reaching range of uses.

Some of the principal reactions catalyzed by this new General Chemical Company fluorine compound are listed at the right. Others are covered in reference after reference in technical literature containing extensive data on the reactions catalyzed by BF_3 as well as by its complexes with other organic molecules. Repeatedly, mention is made of its superiority to other catalysts since reactions are moderated and fewer undesirable by-products result.

Boron Fluoride Etherate is commercially available in drums. Thus, you can investigate it for immediate application in your development or production program, confident that your needs for full scale manufacturing use can be met.

For further information, write to General Chemical Company, Fluorine Division, 40 Rector Street, New York 6, N. Y An outline of your proposed application for this new catalyst will enable our technical staff to work with you toward a solution of your problem.

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BASIC CHEMICALS
GENERAL CHEMICAL COMPANY
FOR AMERICAN INDUSTRY

Physical Properties

Formula:

$$\begin{matrix} C_2H_5 \\ C_2H_5 \end{matrix} \Big\rangle O.BF_3$$

Molecular Weight: 141.9
Melting Point: Less than —60°C
Boiling Point: 125°C
Specific Gravity: 1.14 at 25°C
%BF_3: 47.8% min.

Some of the Principal Reactions Catalyzed by BF_3

1. Polymerization of unsaturated compounds such as olefins, diolefins, vinyl ethers, fatty oils, and terpenes. The products may be solid polymers useful as plastics or liquids as in the bodying of drying oils for paints and varnishes.
2. Condensation of aromatic nuclei with olefins and diolefins, paraffins and olefins, and aromatic nuclei or olefins with acids.
3. As a cyclizing agent for rubber.
4. As an esterification catalyst.
5. As a catalyst in the synthesis of aliphatic acids from alcohols and carbon monoxide.
6. As a promoter and dehydrating agent in the sulfonation and nitration of aromatic compounds.

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. . . *because* the Texas Coast Country is today's Golconda, and its nabobs are the industrial chemists who create a list of items more useful than diamonds from the by-products of its refineries and from its *natural gas* (58% of U. S. reserves).

Your plant will prosper on the Texas Coast. Here it will have demonstrable advantages over plants located elsewhere. Here are its raw resources; here are its allied industries; here are the rail and steamship lines which link it with its markets.

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Wholesalers of Natural GAS

*Author of this classic: "If I owned Texas and all Hell, I'd rent out Texas and live in Hell!"

READERS' VIEWS and COMMENTS

Re: Global Engineering

To the Editor:

Sir:—In your February, 1944, survey of "Global Engineering," the writer predicted that American chemical engineering practices would shortly spread over the world and carry professional men with them in the same way that mining engineering had done in prior decades.

Recently the author was asked to spend some time in the Argentine as a technical expert in connection with the development of chemical industries there. By Pan-American clipper, Buenos Aires is as close to New York as many points in the U. S. Midwest are by train. This ease of transportation makes for ready interchange of thought and industry. After several weeks in the Argentine, one reaches the conclusion that requests will be made in increasing numbers for the exportation of technical brains, processes and know-how from the United States, with native organizations there avidly desiring this commodity at reasonable and not exorbitant commercial prices.

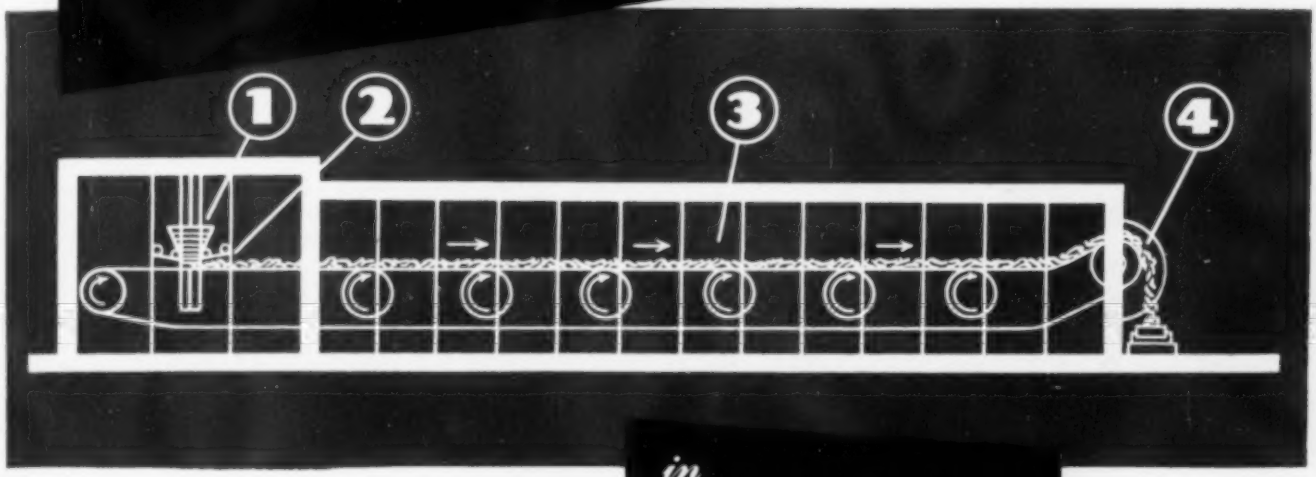
The Argentine, blessed with fertile and abundant farms, is still in an agricultural economy. Its major domestic markets are in the province and city of Buenos Aires where the greater portion of the population resides. Its large exports of agricultural products are helping to feed a hungry world. It is to be expected, therefore, that there is tremendous interest in chemurgy. For example, special technologies of paper manufacture are based on grass and straw as raw materials.

Lumber, for the wide variety of structural and industrial uses to which it is applied in the United States, is lacking. Industrial, residential and municipal construction depend on concrete, both with and without steel reinforcing. The variety of concrete structures combining locally manufactured cement and domestic ingenuity is amazing. Argentina looks forward to its own steel industry. Metals such as aluminum, magnesium, copper and brass are in the main imported products, while zinc is currently the subject of industrial development using American engineering know-how. The Argentine lacks sufficient oil and coal so that automotive fuel is normally 50 percent petrol and 50 percent al-

ZINC OXIDE

REDUCED TO 0.25% (B.D.W.B.*) MOISTURE CONTENT AT RATE OF 1,830 POUNDS PER HOUR

*BONE DRY WEIGHT BASIS



in PROCTOR *Continuous Conveyor System*

Tonnage production of thoroughly, uniformly dried zinc oxide was converted from a production dream into a reality with the installation of a Proctor continuous conveyor drying system, combined with a preforming feed.

Here is how the Proctor system operates in the handling of zinc oxide. ❶ Having been mechanically dewatered by means of a continuous filter, the still highly moist zinc oxide is deposited into the hopper of a Proctor rolling extruder feed. ❷ In this rolling extruder feed, the material is forced through a perforated plate by rolls moving back and forth and deposited in spaghetti-like extrusions onto the conveyor of the dryer. This particular type of preforming feed is used because the physical characteristics of the zinc oxide are such as to permit it holding a definite shape after extrusion. ❸ Entering the dryer, with a moisture content of 69.5% (B.D.W.B.), these extrusions of zinc oxide lie in a bed on the perforated plate continuous conveyor of the dryer. The shape of the uniformly thick extrusions makes it possible for heated air at a temperature of 275°F. to circulate *through* the bed of material—thus promoting rapid diffusion and subsequent speedy, thorough and uniform drying. ❹ After 105 minutes of drying time, the extrusions of zinc oxide are discharged with a moisture content of 0.25% (B.D.W.B.)—uniformly dried at the rate of 1,830 pounds per hour (C.D.W.).

This installation represents one more instance where Proctor engineers converted facts gathered in the laboratory and translated those facts into a drying system that is meeting a specific need in the chemical process industries. Each Proctor system is individually designed to meet individual product and plant requirements. If drying is a part of your plant operation, you may be pleasantly surprised at what an individually designed Proctor drying system can do for your production. Consult Proctor engineers without obligation.

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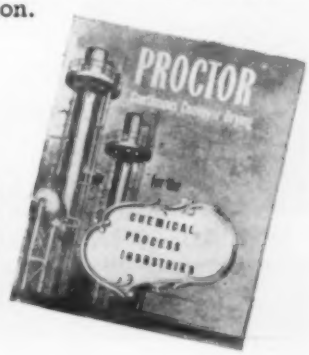

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cohol. The latter is produced by fermentation of maize or corn, to some extent on a subsidized basis.

The universities and technical schools are making strenuous efforts to develop competent faculties and to train chemical engineers in the sense that we know them, rather than as analytical and industrial chemists as was formerly the custom.

The multi-language ability of the native Argentine businessman astounds and to some extent confounds the normally tongue-tied American in his excursions in foreign languages. At your suggestion, I found time to call on James Downey, McGraw-Hill International's representative in Buenos Aires. After a hesitant beginning in Spanish, I found he spoke American with a delightful Irish brogue. I was bold enough to ask how long he had been in the Argentine. He informed me that he was a second generation native born, and he then introduced me to Miss O'Rourke, his secretary, who spoke a delightful Spanish, but little or no English. Names are apt to be most misleading, with Jones speaking only German, Cavanaugh only Spanish, and Steffano only French.

CHARLES L. MANTELL
Consulting Chemical Engineer
New York, N. Y.

Where Credit is Due

To the Editor:

Sir:—I find on page 202 of the June, 1947, issue of *Chemical Engineering* an article entitled "Soviet Scientists Develop Chrome-Plating Process," and I wish to inform you that the process described is absolutely copied from our own applied and patented processing, which during the war had done very good services to the Armed Forces, particularly to the submarine and small Navy vessels. I feel that I do not exaggerate that this process made it possible for the submarines to stay out at sea for a long time because, barring enemy action, it is the Diesel engines which go wrong and in the Diesel engine game the cylinder and piston ring is the touchy spot.

H. VAN DER HORST
President
Van der Horst Corp. of America
Olean, New York

Correction

Through a drafting error the ordinates of Figs. 2 and 3 in the article by Arne Bergholm on page 119 of our June issue were mis-labeled gallons per minute, whereas they should be gallons per hour.—*Editor*

NEWS FROM ABROAD

Special Correspondence

INCREASED CHEMICAL PRODUCTION IN GREAT BRITAIN STILL FALLS SHORT OF CONSUMING DEMAND

A CONTINUED improvement in supplies of many heavy and fine chemicals marked the pre-holiday period, but while delivery delays were largely eliminated, consumers still find it impossible to accumulate stocks. For the most part they operate on a hand-to-mouth basis, and when special difficulties arise the inevitable result is a slowing-down of operations, such as has occurred in the motor tire industry through lack of carbon black. As coal still is the most critical raw material, some of the leading chemical firms have prepared plans of operations designed to fit variations in coal supplies.

Imperial Chemical Industries Ltd. report that at an annual output rate of 200,000,000 tons, the official minimum target of the British coal mining industry, I.C.I. plants will be able to work at 85 percent of capacity. This is probably not far from the present production ratio in the British chemical industry as a whole. The obvious conclusion is that chemical manufacturers cannot hope to increase their production without a corresponding rise in coal output.

Prospects for such a rise in coal supplies are not particularly good at the moment. The enthusiasm with which the miners greeted the introduction of the five-day week in the mines has quickly evaporated, and output figures at present are below the high levels of May. The National Coal Board has threatened to take disciplinary action against individual miners, and the Minister of Fuel has spoken of the possibility of closing one or two pits where absenteeism is rife. It remains to be seen whether such stern language will have the desired effect.

The holiday season naturally will result in a decline of coal production, but later the influx of new labor into the mining industry and the installation of new machinery in connection with the rationalization drive of the Coal Board should help to raise the output. Meanwhile, however, more chemical plants will come into operation. During the second half of this year a substantial amount of new capacity installed under postwar extension schemes will come into operation. Though much of this additional plant will operate on fuel oil or use economical methods of heat and power generation, the additional demand for coal can obviously be met without a reduction of the overall rate of capacity utilization only if coal production in the mines rises above the present level, and of this there is at present no definite evidence.

Prices for Chemicals

Contrary to expectations, few chemicals have been advanced in price at mid-1947, though there is still a likelihood of a general rise in fertilizer prices. Cost of chemical plant, on the other hand, continues to increase, with the result that earlier calculations of the capital involved in new chemical ventures have had to be revised. Quite a few chemical companies have made announcements to this effect, and several leading firms have stated their intention to resort to the public market for additional finance.

The abundance of money and the low rates of interest prevailing in the financial markets favor public share issues, but the higher cost of new plant must inevitably bear all the heavier on producing costs as modern chemical installations have a relatively short "expectation of life" and thus necessitate a high rate of depreciation. Nor is this the only factor adding to manufacturing costs. Interruption of regular operations at short notice as a result of fuel and transport difficulties, employment of untrained labor necessitated by the shortage of skilled men in certain areas, a generally high rate of labor turnover due to unsettled postwar conditions, use of substitute materials and other forms of improvization cannot but have an adverse effect on the level of producing costs, and it is only by continuous research and attention to operational efficiency that more far-reaching changes in costs and prices are avoided.

Difficulties in the erection of new plants have also been caused by the severe winter which retarded building operations and by uncertainties concerning government-owned war factories which were turned over to private enterprise for peacetime development but had in some cases to be re-allocated in the light of changing circumstances. Development plans of different companies are naturally not always coordinated from the outset, with the result that where the authorities insist on new plants being set up in so-called development areas—districts which before the war suffered from large-scale unemployment or other handicaps—difficulties may be encountered in the recruitment of certain types of labor. These obstacles to smooth output expansion are so great that some of the largest companies prefer to rely on extensions to existing works for short-term additions to their normal production.

Thus Courtaulds, the leading synthetic fiber producer in the British Isles states: "No one can accurately forecast when stability in prices will be reached, and in so far as yarn and staple fiber are concerned, our present policy is to augment production in existing mills wherever that is found to be possible." The company mentions only two exceptions from this rule—a new plant at Sellafield, West Cumberland, in which acetate yarn is to be made (originally tire yarn was to be made here, but this will be spun in the unoccupied part of the Courtaulds factory at Preston), and a plant at Carrickfergus, Northern Ireland, where machinery is to be installed for the continuous viscose yarn process of the Industrial Rayon Corp. of the United States.

British Nylon Spinners Ltd., in which Courtaulds and I.C.I. are equally interested, are also faced with building delays. The pilot plant only is working, and though every effort is being made to get on with building the main factory as fast as possible, production of nylon yarns in Britain still is confined to smaller works at Coventry and Stowmarket. The British Celanese Ltd. is experiencing difficulty in the completion of its expansion program. Of the total cost of

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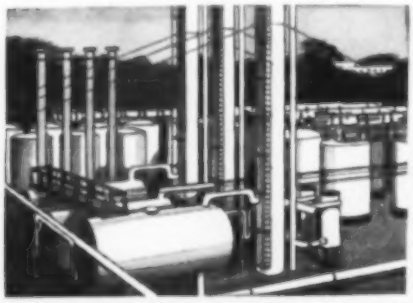
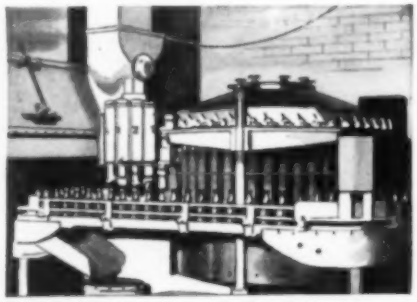


A LARGE CHEMICAL PROCESS PLANT always had trouble protecting the exterior of pipelines which were exposed to caustic-fume-laden atmosphere. They ended their troubles with Ucilon 400. It's now 22 months since it was applied—and it's still going strong. No former coating had lasted even 6 months!



BOTTLING PLANTS all over the country are turning to Ucilon 400. In one plant, painting of bottling machines was considered to be almost useless—the job never lasted. Ucilon was tried. They now report that nothing ever used before even approaches the *2 years* Ucilon has been withstanding the high humidity and spillage!

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this program which was estimated at £6,000,000 half was to be met by new outside finance; the directors have now announced that they propose to issue £1,812,500 of new preference shares. In another field of the synthetic fiber industry, the board of I.C.I. has approved plans to spend £500,000 on adapting wartime factories at Dumfries, Scotland, to the production of Ardil, the new fiber derived from ground nut protein for which wool-like qualities are claimed.

In the plastics industry production capacity for polyvinyl chloride which is now in short supply will be greatly increased by projects in South Wales and Scotland. The production of "nylon salt" at Billingham has been held up by lack of building labor and materials and is not now expected to begin before the end of this year; by the middle of 1948 it is hoped to have plant in operation with an annual output capacity of 5,000 tons. British Cellophane Ltd. reports that its schemes for enlarging production are gradually taking shape. There is thus no lack of evidence of further expansion in this part of the industry.

At the same time it must be said that it is probably the most vulnerable of the chemical trades. In the finishing section of the British plastics industry, which during and before the war witnessed an invasion by many small and inefficient firms, saturation point has already been reached as far as some thermo-softening plastic materials are concerned. Extension plans here must therefore be selective. The experience of this trade is of general interest insofar as it is the only one with chemical connections in which supply has yet overtaken demand.

New Weed Killer Plant For Australia

A REPORT from Melbourne says that Imperial Chemical Industries of Australia and New Zealand (Icianz) has completed a pilot plant for production of methoxone, a weed killer technically described as the sodium salt of 4-chlor-2-methylphenoxyactic acid. Erection of a full-scale production plant has been commenced, but its completion is being delayed by labor and material shortages.

The Council for Scientific and Industrial Research has carried out tests on more than a hundred noxious weeds with methoxone and two other growth-regulating chemicals in three concentrations. It has been shown in experiments that the dreaded Bathurst burr is readily killed by methoxone if sprayed prior to burr formation, and it is anticipated that Noogoora burr will react in a similar way.

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  Surface density approx. .05 lbs. per sq. ft. of approx. 3/16" thickness. Bulk density, approx. 4 lbs. per cu. ft.
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  (graph on request)—at low temperatures — approx. 1/3 thermal conductivity of standard insulating materials. At 2000° FA.—by far the lowest of all materials available.
- AVAILABLE FORMS:
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LARGE PROJECT FOR PRODUCTION OF OIL FROM COAL UNDER CONSIDERATION IN SOUTH AFRICA

PREPARATIONS for establishment in South Africa of an oil-from-coal industry, with an initial capital investment of between £12,000,000 and £20,000,000, have reached an advanced stage, and legislation to pave the way for this development will be introduced in Parliament this year by the Minister of Economic Development. Reports that the State itself will embark on the extraction of oil from coal are without foundation.

It is understood that representations have been made that such an industry could be established economically in the Union without the help of a high protective customs tariff. Although no financial assistance from the State, either in the form of subsidies or otherwise, will be needed, a large amount of capital will be required. It is understood that the State is prepared to insure that the industry, particularly in the early stages of its development, will not be subjected to unfair competition. Some authorities claim that gasoline could be produced in South Africa at a cost of between 6d. and 7d. (15 cents) a gallon if the latest methods are used.

No details of the proposed legislation can be obtained from official quarters, but it is expected that provision will be made for a measure of State supervision over the development of the industry, which has strategic as well as economic value.

Representatives of the French chemical and dye manufacturing industries have been visiting South Africa, and report that the French chemical industry should very shortly be in a position to export a big range of lines to the Union. The difficulty at present was in obtaining a sufficient quantity of raw materials and in shipping the finished products to such export markets as South Africa.

Aircraft and a new poison which is more effective than DDT against locusts have been mobilized in a blitz in districts of the north-eastern Cape. This poison, benzene hexa-chloride, which is produced at the government chemical factory at Klipfontein, near Johannesburg, is not only more effective than sodium arsenite, which has been used up to now, but, unlike its predecessor, it is non-poisonous to humans and cattle, and is non-injurious to the veld. The Chief Locust

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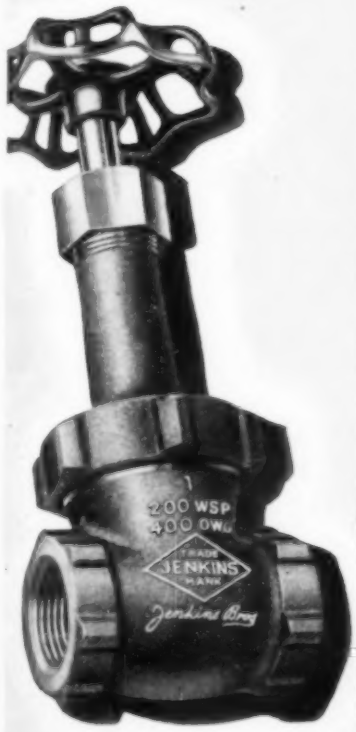
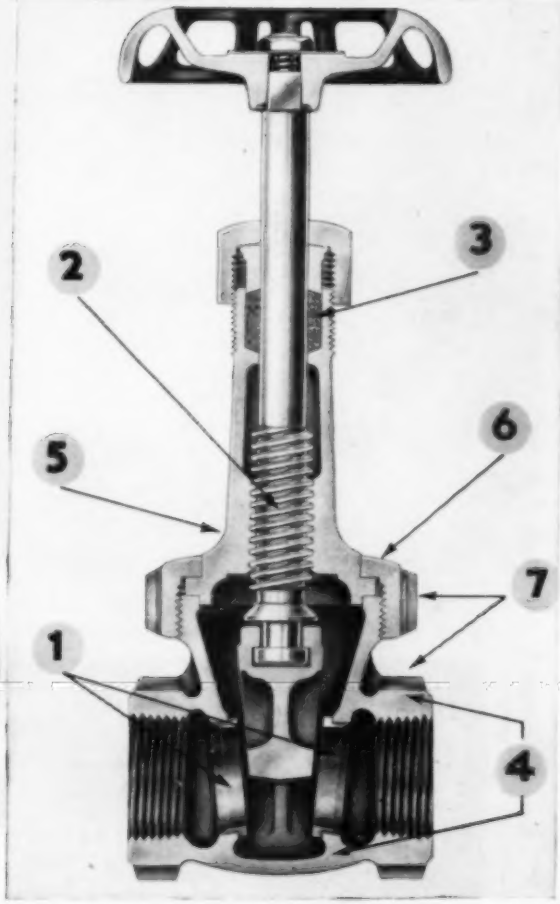
JENKINS FIG. 270-U BRONZE GATE VALVE





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3. DEEP STUFFING BOX—MORE PACKING Deeper than most 200 lb. gate valves, it holds more packing. Keeps stuffing box tight around spindle with less friction, and packing nut can be turned with less effort.

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5. EXCEPTIONALLY RUGGED BONNET Projection on bottom assures snug fit into neck of body. Large diameter Acme threads, with long bearing, assure improved wear resistance. Machined bevel on underside matches beveled shoulder on spindle for back-seating under pressure and protecting spindle threads when valve is wide open.

6. HEAVY BONNET RING Union Bonnet joint withstands exceptionally high hydraulic pressures. Liberal thread engagement assures assembly that can be made tight and kept tight after repeated disassembly.

7. BODY AND BONNET RING LUGS Rugged sturdy lugs of novel design on body ends and bonnet ring permit repeated application of conventional wrenches.

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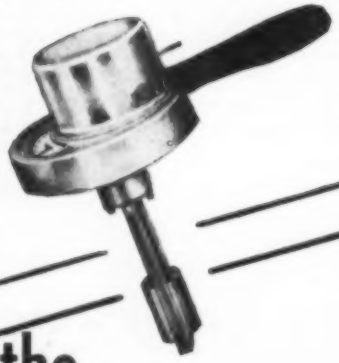
are you stuck

with a Viscosity Problem too?



the BROOKFIELD synchro-lectric VISCOMETER is

rapid
sturdy
simple
accurate
portable

Send for Bulletin giving complete information and description.

BROOKFIELD ENGINEERING LABORATORIES, INC.

Dept. C, 2 Porter St. Stoughton, Mass.

Officer recently watched experiments made by aircraft in a wide area of the Cape Province. The experiment was to determine the density of the poison spray needed to kill swarms on the wing.

A much purer form of oil has been extracted from seal blubber since methods practiced by oil-manufacturing firms were introduced in South Africa, according to a statement by the superintendent of the Government Guano Islands. He showed two bottles of oil extracted by the old process and the new. The former was dark and the latter pure and light. The difference, he explained, lay in the amount of free fatty acid, an undesirable ingredient, contained in each. Under the new process much less free fatty acid was present. The seals were caught on the islands along the South African coast from Port Elizabeth to Luderitz.

Williams Hunt (South Africa), Ltd., recently concluded an agreement with the General Tire and Rubber Co. of Akron, Ohio, under which the American company, in partnership with the South African company, will finance and operate a new tire and rubber manufacturing company in South Africa. Formation of the General Tire and Rubber Co. of South Africa, Ltd., is practically completed. Arrangements have been started for the erection of a factory and importation of the necessary machinery. Managing director will be F. Howard Smith, a veteran of General Tire.

Despite expressed fears and occasional complaints that the volume of chemical imports into South Africa has fallen off a little, South African industrialists on the whole seem to be having little difficulty in obtaining the bulk of their chemical requirements from overseas. It is only in the case of a few industries that difficulties are encountered. The fertilizer factories are able to import considerable quantities of raw phosphates but these are not sufficient to meet the huge demand. In other branches of industry suitable chemicals have been available in ample quantities and in the right qualities. In some cases it is possible for manufacturers to obtain requirements from South African chemical factories but for a large range of their needs they are still dependent to a very large degree on imports.

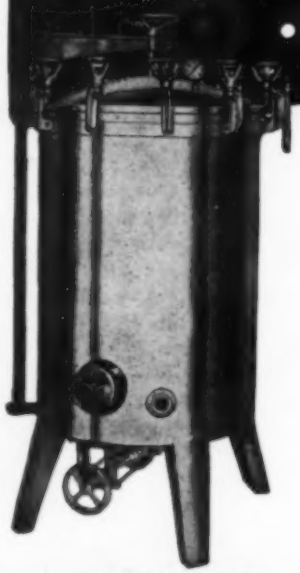
India Has Five-Year Plan For Chemical Expansion

A BLUEPRINT by which India could achieve self-sufficiency in most heavy and electrochemical industries over a

The Heart of a Good Filter is its FILTER LEAVES!

You Can Depend On KLEIN FILTERS and FILTER LEAVES

- Positive Filtration . . . No Clogging
- Full Drainage



Klein Ideal Diatomaceous Earth Filters and the exclusive Klein Filter Leaves, in combination, assure positive filtration at all times. Operation, cleaning and maintenance costs are at a minimum with Klein Filters. In addition, many radical innovations are incorporated in Klein Ideal Filters. You'll want to know about all of these if you have an industrial, chemical or food filtration problem in your plant.

Write for latest Klein Bulletin

Klein Filter Leaf—If damaged, metal cloth easily replaced. No rivets. Note horizontal headers—central duct—Klein Cleanout Cap.

Established 1909

KLEIN FILTER & MANUFACTURING COMPANY

1225-29 School Street • Chicago 13, Ill.

Your plant has danger spots you may be neglecting . . . where corrosion is continuously at work doing expensive damage to structures and equipment.

Guard *all* your plant from moisture, fumes, smoke and weather with Flintkote HYDRALT* Protective Coatings.

Hydralt is Flintkote's registered name for asphalt in its most modern form... a stable, mineral-colloid emulsion. And on metal or masonry, anywhere in your plant, Hydralt Protective Coatings give you important *acknowledged* advantages over cutback asphalts or hot asphalt coatings.

You can apply *Hydralt* Protective Coatings *cold* with trowel, brush or spray, depending on requirements and the type used. Odorless and non-toxic, easy and economical to use, Hydralt Protective Coatings will not crack, craze or alligator under exposure. And they will not flow under heat or become brittle when cold.

Durable? Indeed they are. Tests prove that Hydralt Protective Coatings will outlast any other form of bituminous coating exposed to weather.

Check up. See how many places in your plant need protection. Then . . . for full details on how you can protect them... write for our latest folder on *Hydralt Protective Coatings.*

THE FLINTKOTE COMPANY
INDUSTRIAL PRODUCTS DIVISION
30 Rockefeller Plaza, New York 20, N. Y.

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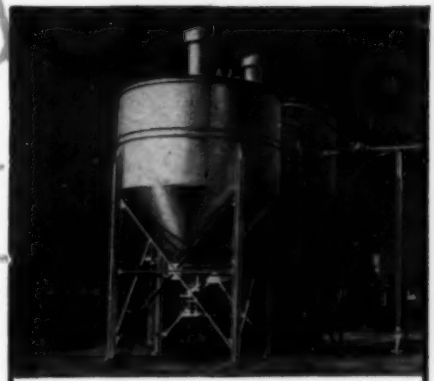
FLINTKOTE
Products for Industry



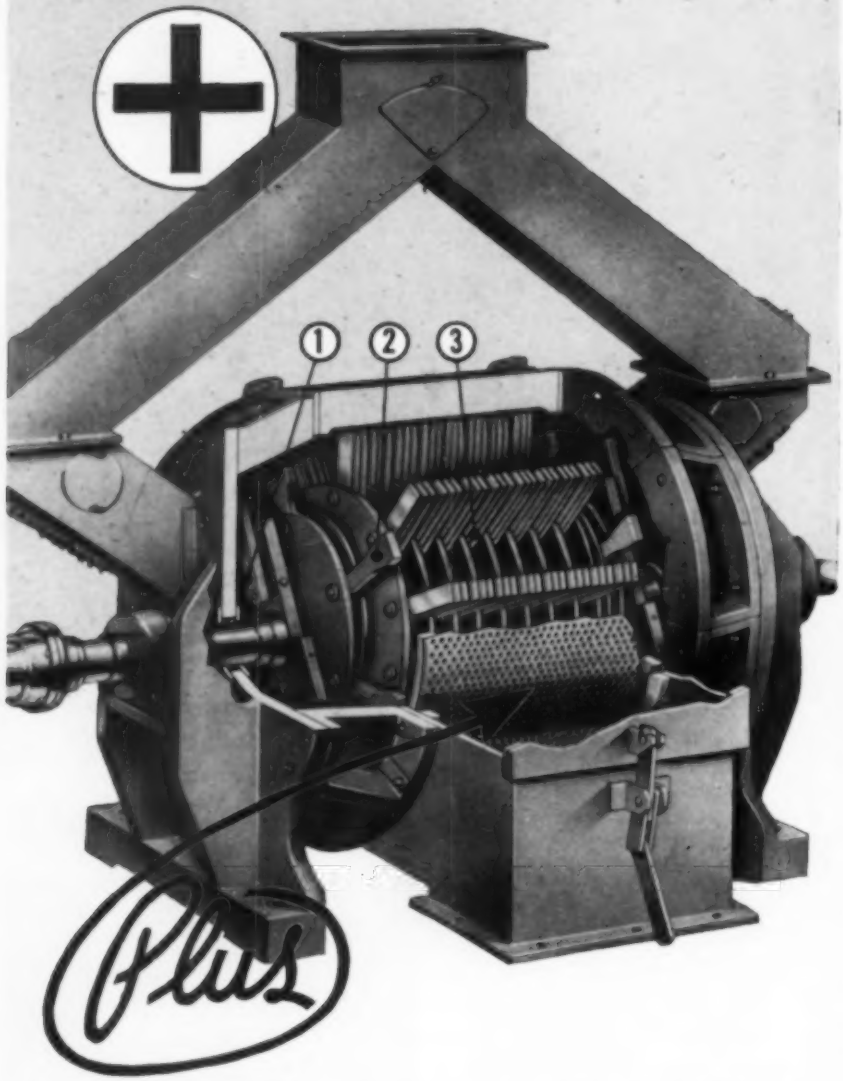
BRIGHTEN UP...
Use Flintkote ALUMINUM PAINT

Flintkote Aluminum Paint is the answer to the problem of adequate protection where light reflectivity is a factor.

For best protective results, use Flintkote Aluminum Paint over the proper coating of Hydralt Protective Coating.

Flintkote Aluminum Paint (asphalt base) is compatible with bituminous coatings. When used over asphalt, it will not cause bleeding, a common characteristic with oil base paints.

TRIPLE REDUCTION



SCREENING EFFICIENCY

The Prater Dual Screen Pulverizer offers you the many advantages of the Triple Reduction Process, plus the added screening efficiency of the Dual Screens —that cover 70% of the final sizing chamber.

The combination of precrushing (1), secondary crushing and peripheral distribution (2), the wide selection and arrangement of the final sizing blades (3), together with dual screens and flexibility of screen selection results in accurate control of granulation.

Write for full information.

PRATER PULVERIZER COMPANY
1515 South 55th Court • Chicago 50, Illinois

PRATER PULVERIZERS

five-year period has been prepared by two government-appointed committees. With the present upset political and economic conditions, however, it appears unlikely that any concerted action will be taken under the plan for some time.

Its details nevertheless present an interesting picture of the Indian situation. Among the heavy chemicals the output of sulphuric acid, now estimated at 59,000 tons annually, would be increased to 152,000 tons by the construction 15 10-ton a day plants, a government experimental 35-ton a day plant to make acid and sulphur from gypsum, and another 35-ton a day plant in the Madras gypsum section.

Soda ash, with a current production of 74,000 tons, would be upped to 270,000 tons (as against current requirements of about 108,000 tons) by the construction of four new 50,000 ton plants. Caustic soda, with a production of 12,600 tons compared with requirements of 55,000 tons, would be increased to 133,000 tons by licensing of about ten 10,000-ton plants.

Among the electrochemicals two 400-ton hydrogen peroxide plants are recommended. Aluminum, where output now is about 7,500 tons annually would be increased to 15,000-20,000 tons by the construction of one more 10,000 ton a year plant.

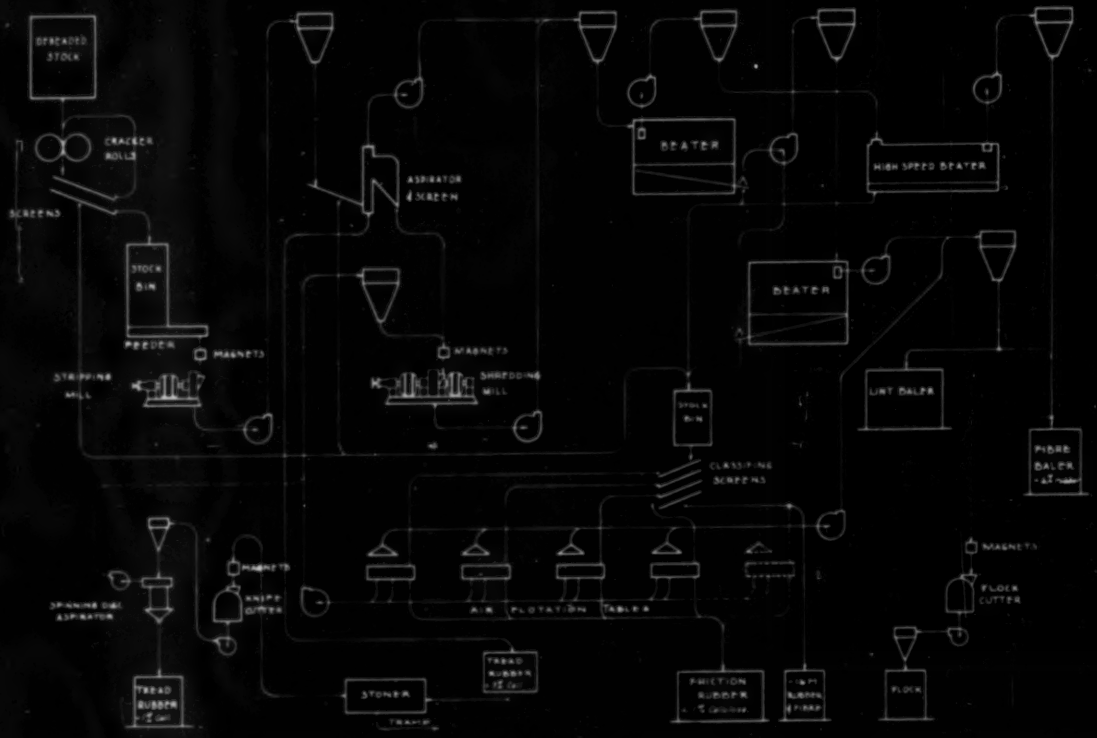
With regard to magnesium, of which India produces none at present, government is urged to install a 3-5 ton a day Pidgeon-process plant and purchase 1,000 tons of the metal abroad for resale to manufacturers at cost. The 6,000-ton-a-year copper output would be increased to 10,000 tons by opening up deposits in Jaipur and Sikkim and by encouraging copper pyrites imports.

The committee expects with the completion of many hydroelectric projects now under construction the greater availability and lower cost of power will provide a great encouragement to developments in the electrochemical field.

Canada To Increase Output Of Sodium Sulphate

CAPACITY of the sodium sulphate reservoirs of the Saskatchewan government at its Chaplin Lake plant are being enlarged. Originally planned to produce 50,000 tons this year, this enterprise which is operated by Saskatchewan Minerals a provincial crown corporation, will be stepped up to produce at least 80,000 tons. It may be that an even higher production may be attempted as a result of recent conferences at Montreal and New York between pulp and paper

Adaptioneering AT WORK



Typical of successful ADAPTIONEERING is this Sprout-Waldron mechanical tire reclaiming system.

The reclaiming industry has long been attracted to the idea of separating tire rubber and fiber economically and efficiently. The Sprout-Waldron mechanical method illustrated above offers all the advantages accruing from devulcanizing fiber-free rubber as well as the attractive reclaim potentialities of the fiber normally lost in the caustic method.

The system is essentially a series of specific size reduction and classifying operations, based on Sprout-Waldron units modified to meet the conditions imposed . . . an outstanding example of ADAPTIONEERING.

Sprout-Waldron has promoted its ADAPTIONEERING service as a result of many requests for assistance from the processing industry for help in specific problems. The combination of fine machines and engineering skill, developed through Sprout-Waldron's many years of processing experience, adapted to highly specialized applications has produced in many instances exceptional savings in labor and material costs.

If your processing involves size reduction, mixing or blending, size separation or classification, or the handling of materials in bulk, you may realize considerable savings by consulting Sprout-Waldron. Our valuable ADAPTIONEERING service — ingenuity + machines + experience — is at your command.

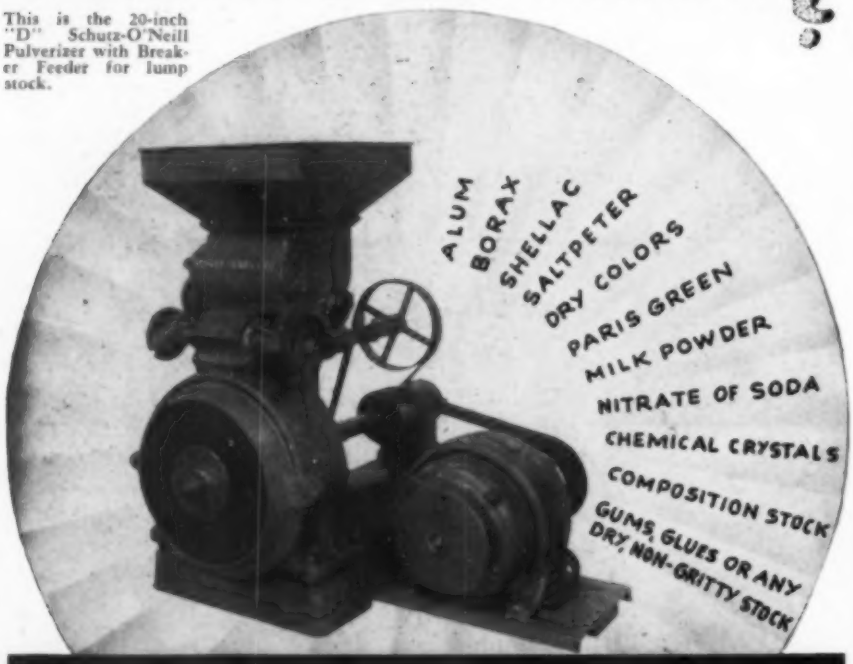
SPROUT-WALDRON & COMPANY

Manufacturing Engineers

MUNCY **PENNSYLVANIA**

WHAT DO YOU PULVERIZE?

This is the 20-inch "D" Schutz-O'Neill Pulverizer with Breaker Feeder for lump stock.

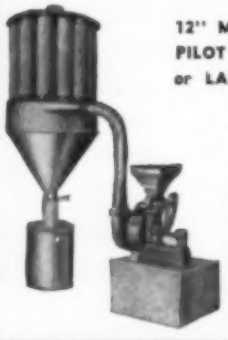


You Can do it Finer, Faster and Better

with the

SCHUTZ-O'NEILL PULVERIZER

The Schutz-O'Neill Pulverizer is a centrifugal air force impact pulverizer for continuous or batch operation. For extremely fine grinding and uniformity, the principle of centrifugal impact when carried by the air stream has never been surpassed. The product is floated off on air — there is no screen to clog or wear out. Thousands of Schutz-O'Neill Pulverizers have proven their sturdiness, long life, low power consumption, high output and ease of operation. With a range of sizes in several styles, any dry, grindable stock can be efficiently pulverized.

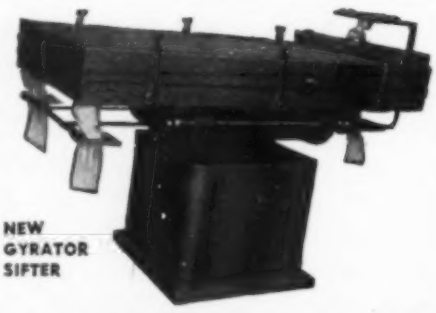


12" MILL for PILOT PLANT or LABORATORY

For coarse, medium or fine grinding. Cyclone Collector and Tubular Dust Collector in one compact unit. Capacity 20 to 150 lbs. Ball bearing requires only 2 to 3 H.P.

CONSULT US ON YOUR PULVERIZING PROBLEMS

Schutz-O'Neill has a great variety of Mill Plans for different purposes. If you will write us your requirements, products to be pulverized, output desired, and send a sample, Schutz-O'Neill engineers will recommend the correct size and type of mill and the most efficient Mill plan for your use. This in no way obligates you. Literature on request.



NEW GYRATOR SIFTER

The new Schutz-O'Neill Gyrator Sifter produces a ground product free from threads, fibre, waste, coarse particles, etc. Made with 1 to 4 sieve frames for single or multiple separation.

ESTABLISHED 1893 SCHUTZ-O'NEILL CO. DIVISION OF PARTEN MACHINERY CO.

PULVERIZERS · BREAKER MILLS · ROLLER MILLS · BURR MILLS · HAMMER MILLS

301 SIXTH AVENUE SOUTH • MINNEAPOLIS 15, MINNESOTA

executives and D. H. Black, a director of Saskatchewan Minerals, and Harry Wilks, its manager of sales.

At present a dehydration plant is being assembled adjacent to the two precipitation reservoirs and this work is expected to be completed before the end of the year. Brine is pumped into the reservoirs in the hot-weather months and in cold weather the salt precipitates out from the saturated solution. Total sodium sulphate production in Saskatchewan in 1946 was 105,768 tons compared with 93,068 tons in 1945.

Tanning Time Reduced By New Wattle Process

In a report from Grahamstown, South Africa, McGraw-Hill World News says that pure wattle tannage time, which formerly took three months to a year, now takes six days through the use of a new process developed by Dr. S. G. Shuttleworth, director of the Leather Industries Research Institute, Rhodes University College. Previously the low acid content of wattle had been a drawback in tanning but in the new method the low acid is an asset. High acid content material, formerly used by tanners, first had to be treated to extract the acid and this step is not necessary in the new process. The method developed by Dr. Shuttleworth is said to have stood the test of large-scale practice and one local tannery is using it in full production. Technical details of the new process are not available and it is said that further information will not be made public for at least a year in order to give an advantage to the local tanning companies.

New Chlorine Plant Will Be Built in Canada

The Dominion Alkali & Chemical Co. of Beauharnois, Quebec, a subsidiary of the Dominion Tar & Chemical Co., Ltd., has awarded contracts for design and construction of a new chlorine and caustic soda plant to The H. K. Ferguson Co. of Cleveland, New York and Houston. The plant will be located at Beauharnois and will have a rated daily production capacity of 60 short tons of chlorine and 67 tons of rayon-grade caustic soda. The plant also will produce hydrogen.

Engineers of the Ferguson company said the design of the plant will be unique because high strength rayon-grade caustic soda will be produced without the use of special evaporating equipment. The latest type mercury cells will be used for

HOW CENTRIFUGAL FORCE helps a Ball Pen *Write Better*

Why the turtle? The story is in De Laval Centrifugal Review No. 2. Write for your copy.

DE LAVAL Centrifugal Clarifiers are used to remove unwanted solid particles from the ink supplied for Eversharp Capillary Action ball pens. Centrifugal force keeps this ink perfectly clean and thus prevents clogging the ball "points" of these famous pens.

This is just another specific instance of how De Laval centrifugal machines speed up a process by making it continuous. Frequently the application is for a much more difficult separation, but a wide range of types and sizes of De Laval centrifugals assures the correct machine for the job.

The De Laval "Nozzle-Matic", for example, separates two liquids continuously, and at the same time removes and continuously discharges solids present in quantities once thought impossible for centrifugal separators.

Write for additional information. It may pay you well and it puts you under no obligation whatsoever.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

De Laval Centrifugal Machines DE

FOR PROCESSING SYSTEMS

This Spool Stops DROOL in FARRIS SAFETY-RELIEF VALVES

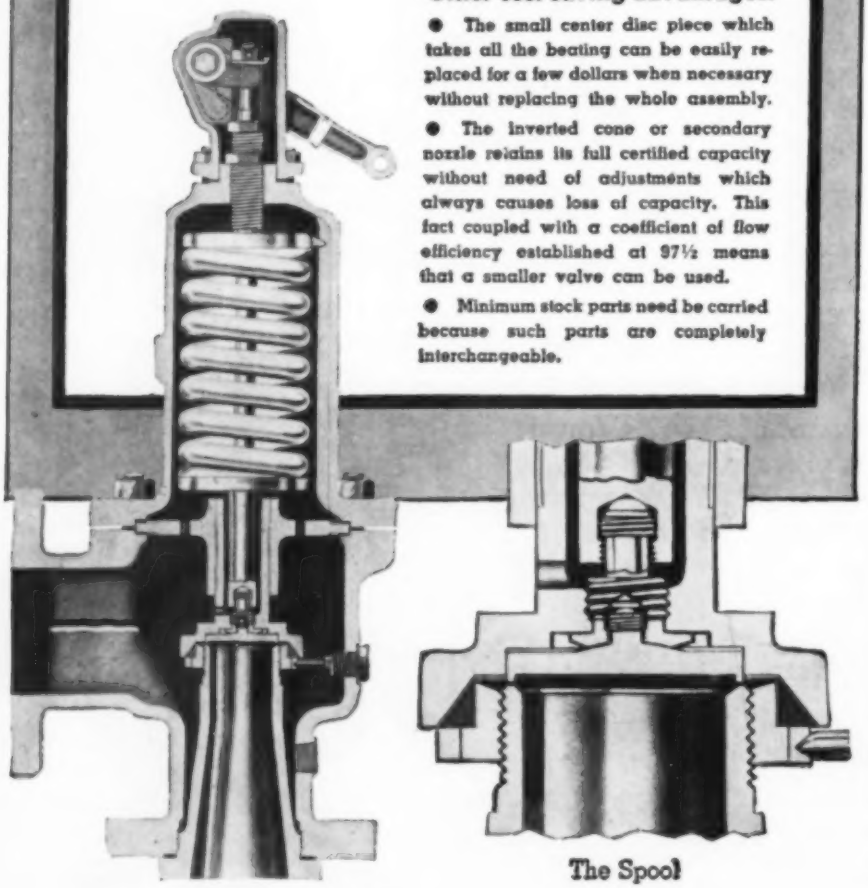
This valve keeps a tight seat with never a sizzle . . .

Because:

- **The double universal joints in the alignment spool — a hardened steel piece threaded into the disc — holds disc and stem in perfect alignment with each other and also with the 2½ to 1 ratio guide cylinder. No cramping is possible and the disc always seats firm and true with a smooth, easy action.**

Other cost saving advantages:

- **The small center disc piece which takes all the beating can be easily replaced for a few dollars when necessary without replacing the whole assembly.**
- **The inverted cone or secondary nozzle retains its full certified capacity without need of adjustments which always causes loss of capacity. This fact coupled with a coefficient of flow efficiency established at 97½ means that a smaller valve can be used.**
- **Minimum stock parts need be carried because such parts are completely interchangeable.**



The Spool

For sizes and capacities and further details write for your copy of the new Farris Catalog.

FARRIS ENGINEERING CORP.
404 Commercial Ave.
Palisades Park, N. J.

Farris

SAFETY and RELIEF VALVES

FARRIS keeps pace with advancing power and process engineering

1000

this purpose. Preliminary engineering has begun and construction is expected to start in the fall.

Business Fairs To Hold Congress in Paris

THE Congress of the International Union of Business Fairs will be held in Paris, France, on October 8-10. Members of the Congress include the fair committees of Utrecht, Potsdam, Brussels, Zagreb, Valencia, Barcelona, Padua, and Bari. Although the London and Basil Fairs do not belong to the International Union, they have been invited to participate.

British Societies

Assn. of British Chemical Mfrs. Joint Mgrs., R. M. Drake and A. J. Holden; Director, J. Davidson Pratt, C. B. E., 166 Piccadilly, London W. 1, England

Assn. of British Insecticide Mfrs. Joint Secs., A. J. Holden and W. A. Williams, 166 Piccadilly, London W. 1, England

Assn. of British Sheep & Cattle Dip Mfrs. Sec., W. A. Williams, 166 Piccadilly, London W. 1, England

Assn. of Tar Distillers. Sec., R. M. Drake, 166 Piccadilly, London W. 1, England

British Animal Medicine Makers' & Allied Traders' Assn. Sec., W. A. Williams, 166 Piccadilly, London W. 1, England

British Assn. for the Advancement of Science. Sec., D. N. Lowe, Burlington House, Piccadilly, London W. 1, England.

British Barytes Producers' Assn. Sec., R. M. Drake, 166 Piccadilly, London W. 1, England

British Ceramic Society. Sec., D. F. W. Bishop, M. A. The North Staffs Technical College, Stoke-On-Trent, England

British Chemical Plant Mfrs.' Assn. Director, Norman Neville; O. B. E. Sec., E. H. T. Hoblyn, 26 Portland Place, London W. 1, England

British Colour Makers' Assn. Sec., A. J. Holden, 166 Piccadilly, London W. 1, England

British Disinfectant Mfrs. Assn. Sec., W. A. Williams, 166 Piccadilly, London W. 1, England

British Non-Ferrous Metals Research Assn. Director, G. L. Bailey; Sec., O. I. Thomas, Euston St., London N. W. 1, England

Faraday Society. Hon. Sec., G. S. W. Marlow, 6 Gray's Inn Square, Gray's Inn, London W. C. 1, England

Industrial Pest Control Assn. Joint Secs., A. J. Holden and W. A. Williams, 166 Piccadilly, London W. 1, England

Institute of Metals. Sec., G. Shaw Scott, 4 Grosvenor Gardens, London S. W. 1, England

Institution of Chemical Engineers. Joint Hon. Secs., M. B. Donald and L. O. Newton, 56 Victoria St., London S. W. 1, England

Iron and Steel Institute. Sec., K. Headlam-Morley, 4 Grosvenor Gardens, London S. W. 1, England

Society of Chemical Industry. General Sec., Lt.-Col. Francis J. Griffin, 56 Victoria Street, Westminster S. W. 1, England

Society of Dyers and Colourists. General Sec., P. A. Wells, 32/34 Piccadilly, Bradford, England

THE CORROSION FORUM

MODERN MATERIALS • MODERN METALS

of Chemical & Metallurgical Engineering

Edmond C. Foller, ASSISTANT EDITOR

Sulphur Dioxide vs. Materials of Chemical Plant Construction

Part II of a symposium in which manufacturers of typical materials evaluate their products for services involving wet and dry SO_3 and sulphurous acid

RUBBER LINING

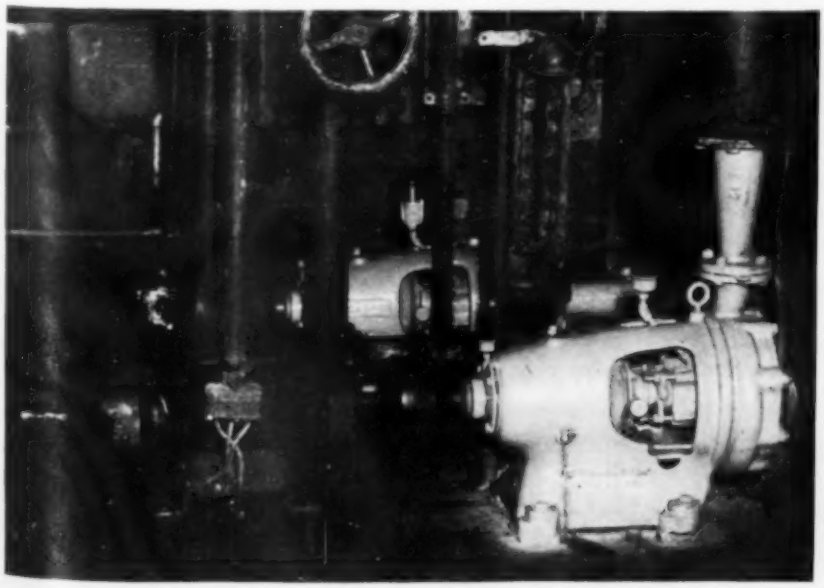
O. S. TRUE

United States Rubber Co.
New York, N. Y.

While rubber lined tanks, pipes and fittings have not found extensive application in SO_2 services, specific compounds of hard rubber have excellent resistance to sulphurous acid up to saturation at atmospheric pressure, and at temperatures up to 150 deg. F. Soft rubber cannot be recommended for SO_2 because of the high rate of diffusion of this gas through such compounds. This diffusion results in failure of the rubber-to-metal bond with subsequent blistering of the lining away from the metal.

Laboratory investigations at atmospheric pressure and temperature of the effects of wet and dry SO_2 have been conducted on natural rubber and all of the synthetics. Results obtained indicate that the gas has a more serious effect on soft and semi-hard rubbers than does sulphurous acid. The semi-hard rubbers are softened appreciably by absorption of the gas. The soft rubbers with the exception of GR-I (butyl) are rapidly diffused and blistered under these conditions. It is likely that GR-I could be used to good advantage in SO_2 service since it has exceptional resistance to gas diffusion. Actual rate of diffusion of SO_2 through this material has not been determined but the exposure tests described above indicated excellent resistance to both solution of, and permeation or diffusion by the gas.

Within the limits of our tests, none of the other synthetic rubbers showed advantages over hard natural rubber.



Two of three Durimet pumps handling 230,000 gal. per day of sulphite cooking liquor (sulphurous acid and calcium bisulphite)

DURIMETS T AND 20

W. A. WATKINS

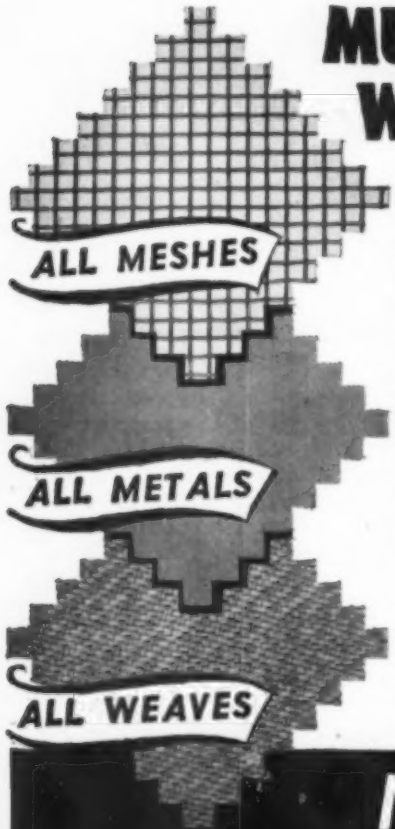
The Duriron Co.
Buffalo, N. Y.

Sulphurous acid, being of unstable composition, is very readily oxidized, in part, to sulphuric acid upon exposure to air. Although 18-8S and 18-8SMo stainless steels are recognized as being satisfactory for pure H_2SO_3, the fact that some H_2SO_4 may be present makes it expedient to select an alloy such as Durimet T (22 percent Ni, 19 Cr, 3 Mo, 1 Cu, 1 Si, 0.07 max. C) or Durimet-20 (29 Ni, 19 Cr, 3 Mo, 4 Cu, 1 Si, 0.07 max. C). Both of these alloys possess excellent resistance to sulphurous acid of any concentration or temperature either with or without sulphuric acid contamination.

In the manufacture of sulphurous acid, the gases coming from the sulphur combustion chambers generally contain some SO_3. If the gases are passed through a spray type washer and cooler, the SO_3 combines with water and the resultant weak sulphuric acid is disposed of. Many installations, however, permit the SO_3 to be carried on through the coolers and into the absorbtion towers. In either case the possible presence of sulphuric acid makes the selection of an alloy such as Durimet a wise one.

Dry SO_2 gas is handled very readily in cast iron and other such materials. In the presence of moisture, more resistant materials are indicated. Durimet is being used successfully under moist SO_2 gas conditions at temperatures up to 900 deg. F. In general, however, the top limit for continuous high temperature operation would be about 800 deg. F.

In the sulphite pulp industry, literally tons of sulphur are burned daily to produce SO_2 gas required for man-



MULTI-METAL WIRE CLOTH

During its more than 35 years of constant service to scores of process industries, Multi-Metal has painstakingly built up the most extensive of all lines of wire cloth. Many special types have been developed for specific processing operations, and it is often possible to greatly increase the efficiency of existing installations by changing to one of these exclusive Multi-Metal patterns.

Wire cloth is supplied by the piece, yard, or roll. A complete range of meshes, weave styles, metals, and standard widths is available from stock.

●

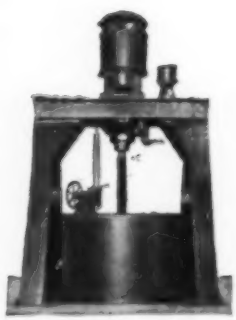
Send for free catalog and wire cloth samples—or send prints and specifications for an immediate quotation.

* Wire Cloth in Fabricated Units, or by the Roll and the Cut Piece.

Multi-Metal
WIRE CLOTH COMPANY, INC.
1350 Garrison Ave., New York 59, N. Y.

HIGH SPEED

IN ACCELERATION BRAKING RUNNING UNLOADING



with LABOR-SAVING large bottom discharge for solids and LARGEST CAPACITY in proportion to basket diameter. And, these sturdy, precision-built machines assure time-and money-saving operation with minimum supervision and maintenance. Write for catalog . . . engineering consultation available.

FLETCHER CENTRIFUGALS

MOTOR-DRIVEN SUSPENDED AND OPEN-TOP

FLETCHER WORKS, 235 GLENWOOD AVE., PHILADELPHIA 40, PA.

ufacturing sulphite cooking liquor. This is usually a solution of calcium or magnesium bisulphite in an excess of sulphurous acid, with the total acid content being in the order of 4.5 to 5.5 percent. Temperatures may run as high as 300 deg. F. Durimets-T and 20 are ideal for use throughout the sulphite mills—from the manufacture of acid to the blowing of the pulp from the digesters.

Durimets-T and 20 are available as engineered process equipment and special castings. The former includes centrifugal pumps, valves, pipe fittings, steam jets and exhaust fans. Durimet-T only is obtainable as cold finished round bar.

Durimet equipment is being used in the following typical industrial applications:

(1) Durimet-T centrifugal pumps for tower circulation and transfer service in sulphite pulp mills.

(2) Durimet T fan handling dry 10 percent SO_2 gas at 230 deg. F.

(3) Durimet spray nozzles in SO_2 gas cooling and scrubbing towers; gas temperature 750-900 deg. F. with cooling water at 125 deg. F.; weak H_2SO_4 formed due to SO_3 in burner gas.

(4) Durimet-T fan runner delivering approximately 14½ percent SO_2 gas at 75-85 deg. F. with occasional traces of sulphuric acid due to SO_3 gas and moisture present.

(5) Durimet-T manhole sleeves, steam coil sleeves, blowoff connections, etc., on Mitscherlich digesters in sulphite mill. Sulphurous content as high as 6 percent at temperature of 275 deg. F.

(6) Durimet top and bottom fittings such as liner sleeves, relief strainers, cover liners, valves and blowoff crosses for vertical sulphite digesters.

(7) Durimet target plates for protecting walls of blow pits in sulphite pulp mills.

The **high-silicon irons**, Duriron (14.5 percent Si) and Durichlor (14.5 Si, 3 Mo) are not recommended for handling sulphur dioxide or sulphurous acid. The same holds true for **Chlorimet 2** (62 Ni, 32 Mo, 3 Fe and 0.10 C) and **Chlorimet 3** (60 Ni, 18 Cr, 18 Mo, 3 Fe and 0.07 C).

ALUMINUM

E. D. VERINK, R. H. WAGNER, R. H. BROWN
Aluminum Company of America
New Kensington, Pa.

BECAUSE of its excellent resistance to attack by sulphur and sulphur products, aluminum has come into wide use for handling elemental sulphur, sulphur dioxide, hydrogen sulphide, sulphurous acid, and fuming sulphuric acid. Oil producers and refiners have found aluminum attractive

71-YEAR-OLD ROOTS BLOWER STILL ON JOB

. . . making mineral wool from iron slag

This cupola blower, fitted with wooden impellers, was installed in 1876 at the Stanhope (N. J.), plant of U. S. Mineral Wool Company (world's oldest manufacturer of mineral wool). Used in making mineral wool insulation from iron slag, it's still working faithfully, 24 hours a day, 7 days a week.

Amazing as this record is, we'll stack our modern blowers against it. Advanced engineering, new materials and methods make R-C Blowers better than ever before. Then, our *dual-ability* to build either Rotary or Centrifugal units permits matching the blower precisely to the job —for better all-round performance, economy and long life.

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708 Illinois Avenue, Connersville, Indiana

Insulation process completed by R-C Blowers

Air from compact, built-in R-C Blowers carries this same mineral wool into every nook and corner for building insulation. Similar units furnish air for widely varying uses—from ice-making to portable forges. High-capacity Rotary or Centrifugal equipment moves or measures air and gases in almost every industry, with a proved record for durability and economy.

You'll find it profitable to consult us on any problem of moving gas or air.

ROOTS-CONNERSVILLE BLOWER BUILDERS R-C SINCE 1854
ROTARY · CENTRIFUGAL
BLOWERS · EXHAUSTERS · BOOSTERS · LIQUID AND VACUUM PUMPS · METERS · INERT GAS GENERATORS

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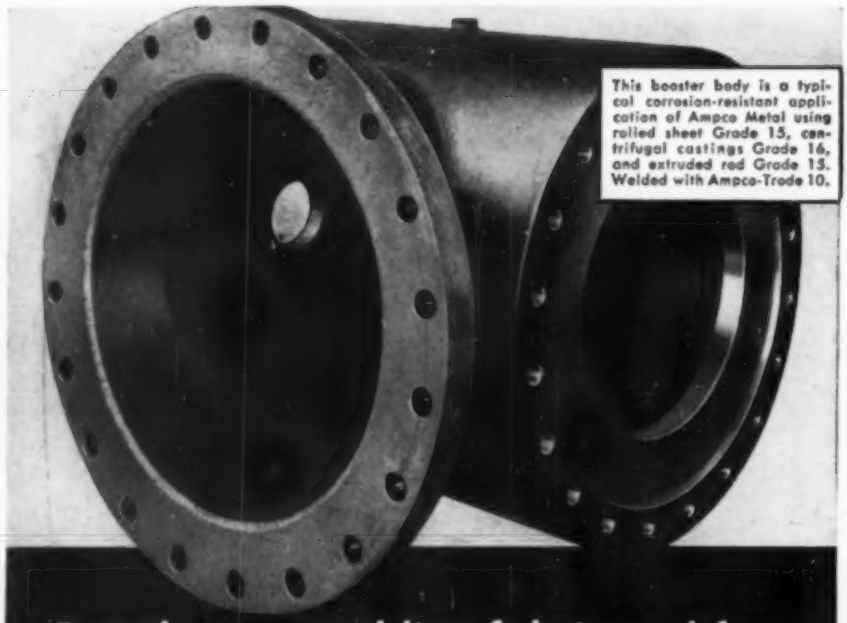


This booster body is a typical corrosion-resistant application of Ampco Metal using rolled sheet Grade 15, centrifugal castings Grade 16, and extruded rod Grade 15. Welded with Ampco-Trode 10.

Complete assemblies fabricated from

Ampco Metal

...and welded with

Ampco-Trode

Coated Aluminum Bronze Electrodes

Longer life... lower cost on units for processing corrosive substances:

In the routing of liquids, semi-fluids, and liquids containing solids in suspension, such as

- Acids
- Petroleum sludge
- Alkaline solutions
- Sea water
- Mine waters
- Food product liquors
- Hot brine

. . . Under varied conditions of

- Corrosion
- Velocity
- Temperature
- Pressure
- Consistency

. . . a combination proved successful where corrosion-resistance is essential

The wisdom of *fabricating with Ampco Metal* and *welding with Ampco-Trode* is being demonstrated daily — in the original construction of complete units subject to corrosive action, as well as fabricated parts.

Ampco Metal is a complete series of aluminum bronze alloy variations, available as castings, forgings, sheets, rods. All surfaces, whether cast or machined, are protected naturally by an oxide film that provides additional resistance against corrosive attack. This film, when injured, replaces or heals itself.

In addition to its ability to withstand the destructive action of a wide range of caustics and acids, Ampco Metal has other desirable service qualities not found in other anti-acid metals: High tensile strength. Good ductility. Less weight. Favorable hardness to resist squashing, wear, impact, fatigue.

Ampco-Trode coated aluminum bronze electrodes give a weld with the same excellent physical properties that Ampco Metal provides in the component parts.

Ask our engineers and production specialists to help you adapt fabricated assemblies to your requirements. Send us your prints for suggestions. Write for bulletins.

Ampco Metal, Inc.

Department CE-8 Milwaukee 4, Wisconsin

Field Offices in Principal Cities

AMPCO Metal

The Metal without an Equal

P-12

because of its resistance to sour crudes which often contain high concentrations of sulphur compounds associated with corrosive brines. Tank roofs in sour crude areas are still in excellent condition after 20 years' service. Aluminum equipment has been used successfully for removal of hydrogen sulphide from natural gases, being used for scrubbers, heat exchangers, reactivators, condensers, and piping.

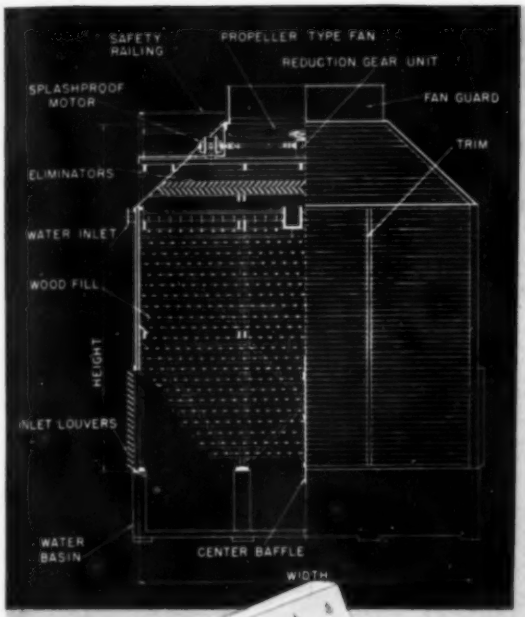
Refrigerating engineers have long recommended the use of aluminum refrigerating systems wherein sulphur dioxide was the refrigerant, as well as for systems utilizing the Freons and methyl formate. Aluminum has also demonstrated its ability to withstand the corrosive conditions encountered in sulphur dioxide towers used in the refining of corn products. The beer industry, too, has chosen aluminum, not only for its resistance to sulphur dioxide, but for its many other attractive properties, such as non-discoloration of product, non-toxicity, and clean appearance.

Aluminum alloys display excellent resistance to corrosion in atmospheres contaminated with the combustion products of sulphur bearing fuels. It is interesting to note that as the length of exposure increases, the rate of corrosive attack of aluminum alloys decreases. The decreasing rate of penetration with time is a characteristic of aluminum alloys, not only in atmospheric exposures but also in many chemical environments. This means that in many instances the estimated life data taken from relatively short term tests will be on the pessimistic side.

To obtain a comparison between the behavior of various alloys of aluminum and mild steel in solutions containing sulphur dioxide, a test was set up in which sulphur dioxide was bubbled through various types of water at the rate of three liters per hour for eight hours. The solutions were then allowed to stand for sixteen hours, following which the gas was again bubbled through the solution for another eight hours. The solutions used in the test were:

Distilled water; distilled water plus 100 ppm. NaCl; distilled water plus 100 ppm. $NaHCO_3$; synthetic tap water containing Cu, Ni, and Co. A similar setup using air in lieu of sulphur dioxide was used as a blank. In each container three specimens were exposed, one totally immersed, one half immersed in order to obtain the effect of the water line, and the third exposed in the space above the liquid.

In the exposures in which air was bubbled through the solutions, none of the specimens were seriously corroded in this short period of time. The aluminum specimens were slightly



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NEW BELT SANDER FOR DRILL PRESS
Does Finishing Jobs Faster, Better

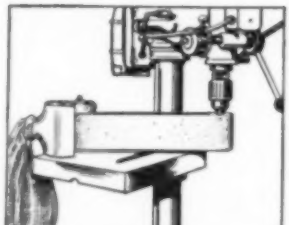
A new, simple, faster method for many surface finishing jobs on wood, metal, plastic and other materials has been announced by the OK Specialty Company of Chicago. The new finishing method takes the form of the OK Belt Sander, a drill press attachment.

The new sanding device weighs less than 5 pounds. It is made up of an aluminum base with backing plate or platen, a driven pulley mounted on ground steel shaft and running on precision ground ball bearings, and cast aluminum driver pulley mounted on ½" ground steel shaft to fit into the drill press chuck.

The base of the sander is bolted to a drill press table. Merely by moving the drill press table, the attachment can be adjusted to handle sanding belts from 26" to 36" in length.

The sander takes belts from ½" to 3" in width. Two sanding belts, one coarse grit and one fine grit, are furnished with each attachment. The device comes assembled ready for use with any drill press. Most efficient performance is achieved at 3500 to 5000 RPM. The sander stands 5" high, and the base measures 10½" long by 3¼" wide.

Another time-saver on the job is chewing gum. Chewing gum may be used even when hands are busy; and under dust conditions helps to keep the throat moist—prevents "false thirst." For these reasons many plant owners make Wrigley's Spearmint Gum available to everyone.



OK Belt Sander
Assembled, Ready for Action

You can get complete information from
OK Specialty Company,
4655 N. Clark St., Chicago, Ill.

AB-71

dulled in appearance in some cases, whereas the steel specimens were rusted. There appeared to be some selective attack at the water line on the steel specimens partially immersed in the solutions through which air was bubbled.

Among the specimens totally immersed in the solutions through which sulphur dioxide was bubbled, alloys 52S and 2S showed the smallest weight loss. The steel specimens in this exposure were completely dissolved. It is apparent that in the absence of chlorides and heavy metals the aluminum alloys suffer negligible attack when totally immersed in sulphurous acid solutions.

Alloy 52S exhibited the smallest weight loss among the partially immersed specimens, followed by 2S, and Alclad 3S. The immersed portions of the steel specimens were again completely dissolved and the attack had progressed above the water line. Again it is apparent that in the absence of chlorides and heavy metals, the aluminum alloys were virtually unaffected.

Above the water line the aluminum alloys experienced negligible corrosion, with 2S and Alclad 3S slightly superior to 52S. The steel specimens were uniformly rusted and suffered moderately severe attack.

From these tests it may be concluded that aluminum alloys are resistant to moist sulphur dioxide and its dilute solutions in the absence of chlorides and heavy metals.

PROTECTIVE COATINGS*

THERE has been some indication that sulphur dioxide might be playing some role in the deterioration of conventional paints. There does not appear to be a great deal of available information on the effect of sulphur dioxide or sulphurous acid on the chemically resistant paints. The available information on proprietary protective coatings are quite meager:

Plant exposure conditions have indicated that Prufcoat has stood up well under fairly strong concentrations of sulphur dioxide. In general, the phenol formaldehyde resins, polyvinyl chlorides, polyvinylidene chlorides, Thiokol, neoprene, and rubber-base materials have good resistance. Heresite, good up to 175 deg. F.; Heresite AD 640, a vinyl resin, recommended up to 100 deg. F. Amercoat is said to be unaffected by sulphur dioxide. Fedelco was tested under varying concentrations for 18 months and gave good results. Quigley Black is not affected. Triple A Nos. 10 and 20 are not affected by SO_2 gas.

* The author of this article is with a large chemical company which uses, but does not produce, protective coatings.

FROM THE LOG OF EXPERIENCE

Dan Gulleben, ENGINEER

Slag from water wall tubes. A vigilant fireman was better than wizard powder

MAC WINKED at the salesman and ordered a cargo of high volatile coal having a low fusion ash and a heavy percentage of sulphur. Its cheapness appealed to his purchasing instinct and he excused himself with the thought that the firemen wouldn't know the difference! However, he couldn't fool the old furnaces with their low ceilings and retort stokers. Presently big stalactites of slag formed below the grates and boulders of solidified lava above. When the old boilers were replaced with new, Mac registered relief. He knew that the specifications called for furnaces designed to burn high volatile, gas slack coal, having a low fusion ash, that accumulated distressingly at the mines for lack of customers. He no longer had to buy a particular quality coal if there was anything offered at a lesser price.

In great glee he bought a pile of so-called coal at 10c. per ton as is. It looked like coal and, surprisingly enough, its calorific value was 13,000 Btu. In spite of green operators devoid of analytical mentality, the new pulverizers and furnaces converted the coal into steam without reverberations profane or mechanical. The boys hadn't bothered with CO_2 readings and blissfully operated at low furnace temperature. In time, however, they remembered that the old furnaces called for a stack gas of 15½ percent CO_2 in order to avoid carbon loss both by way of the ash and the stack. So they reduced the air supply and consequently raised the CO_2 and the temperature.

A clean tube does not immediately attract slag. But continued exposure to a slagging condition gradually builds up a footing and thereafter slag acretes with dispatch. Even at this stage a vigilant fireman can arrest slagging by vigorous use of the soot blower and by reducing the temperature. However if he happens to be wool gathering, the space between the tubes will promptly plug and stalactites will drop from the ceiling. On occasion these falling spears even flatten a tube in the bottom of the furnace. To compensate for the restricted gas passage, the fireman speeds up the draft fans and the resulting blow pipe effect blisters tubes.

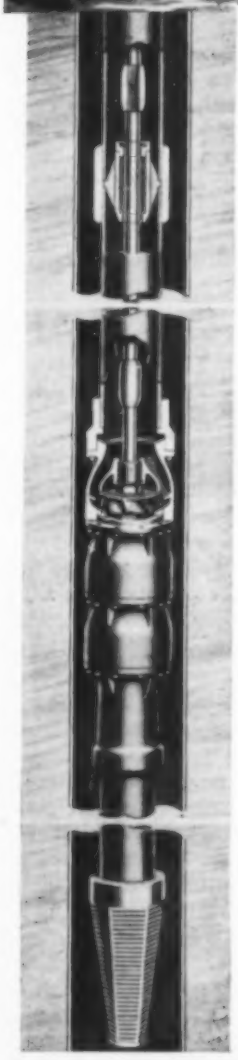
EFFICIENT COMBUSTION demands a minimum of excess air as this excess is heated and then wastefully discharged to the atmosphere. A pound of the coal that Mac usually bought required about 14 lb. of air for combustion, and 14 × 250 × 0.24 (being the weight × temperature difference between air and stack gas × specific heat) = 875 Btu. = the loss of heat by way of the smoke stack for every pound of coal burned. Now if it were possible to burn the coal without excess air, i.e. just enough to oxidize the carbon and the hydrogen, the CO_2 content of the stack gas from Mac's coal would be 18 percent. With 15 percent excess air, the CO_2 content is about 16 percent which is the maximum ordinarily attainable. High CO_2 is accompanied by a hot furnace and a hot furnace melts ash which then builds up on the tubes and walls in the form of slag. With high carbon coal available in the Philadelphia market, we could maintain a CO_2 content of 15½ percent, while with the coal that Mac bought the maximum that permitted slag-free operation, though not without relentless vigilance, was 14½ percent. The hotter furnace suffers a lesser carbon loss both through the grates and the stack. The boilers produced at higher thermal efficiency with the non-slagging coal but Mac's cheap coal made steam at lower cost, albeit accompanied with less comfort to the operators. Moreover, in view of the boast under which the original appropriation for the new boilers was extracted, it was demanded that the low-price, slag-infested coal be used.

INNOCENT ACCESSORIES to the formation of slag, besides the lack of firing know-how, were the savage fluctuations in the steam demand. Furthermore, the sudden and unannounced changes in coal qualities caught the operators unaware. When the furnace was fired with coal having a high ash-fusion temperature and consequently supplied with a lesser excess of air, it might suddenly please Mac to buy a coal of low-fusion ash, and then, under some lack of operator vigilance, slag proceeded to accumulate on the tubes. And finally, the CO_2 meter, due to neglectful maintenance, sometimes indicated 14 percent when the Orsat proved it to be 15. It does not require much to disturb a CO_2 meter that depends on so infintesimal an impulse as the variation of the momentum of the flue gas due to the changing CO_2 content, or as the heat conductivity affected by the same circumstance.

IF DOCTORING slag-infested coal could make it possible to achieve the advantage of high temperature available in the case of non-slagging coal, the firemen could relax at a lesser cost to the House. A professor blew in with a claim that he had discovered a concoction of wizard powder which could accomplish this. The requirement was to add 2¼ lb. per ton of coal. It was difficult to conceive how so little could do so much but the professor exhibited an imposing list of nationally known customers who were reducing their coal bills by at least 5 percent by the use of the powder.

Slagging, the professor avered, is due to the presence of iron pyrites (FeS_2). This he said is readily reduced to FeS which is the Ethiopian in the hedgerow. The extra atom of sulphur can be removed by supplying a heavy excess of air to the furnace, which we were doing with Mac's coal when we

SLASH WATER COSTS



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Conclusive evidence that many companies, where Deming Deep Well Turbine Pumps are installed, are saving thousands of dollars annually is available to you upon request. In several cases, the complete cost of drilling a deep well, installing the Deming Turbine Pump, and all related costs of operation, maintenance, depreciation on the investment, etc., have been paid for by SAVINGS during the first year.

Deming Deep Well Turbine Pumps are built for wells 4" to 16" or larger. Capacities range from 15 to 3,000 gallons per minute. Features of construction are described in a 20-page, 8½" x 11" bulletin. Copy on request.

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THE DEMING CO.
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INDUSTRIAL PUMPS

reduced the CO_2 content. On the other hand if a small amount of chlorine is fed into the furnace, its strong affinity will separate the sulphur and thus remove the slagging tendency. No engineer could abide the thought of feeding chlorine under a steel boiler. The professor therefore supplies it by the vehicle of a compound containing about 70 percent of calcium chloride concealed under some pink coloring matter. He had a plausible explanation and was possessed of certain personal magnetic qualities and so we bought a carload of wizard powder. In the course of three months we dribbled it into 21,300 tons of coal, thereby raising its cost by 6c. per ton. For a month operation proceeded without slagging and the operators thought they had achieved the goal. Then suddenly the old bête noir came back! It was not possible to determine if the cause had any relation to lack of vigilance, misleading CO_2 readings, or Mac's cantankerousness in allowing himself to be stampeded into buying a heap of mine-mouth accumulation during John L. Lewis's disturbing negotiations in 1937. After the first carload of wizard powder had been consumed, we decided to test negatively so as to determine how well intelligent operation could substitute for corrective. Dribbling powder into the coal was discontinued but another carload was stocked just in case.

ON SEVERAL OCCASIONS we sought to physic the furnace after heavy slagging had started. We fed powder with the coal through the pulverizers at the rate of 100 lb. per hr., the coal rate being from 5 to 10 tons per hr. In an hour or two the slag began to fall off. One night a wool gathering bonehead, having spent riotously what time he should have been asleep, suddenly awoke to the fact that the temperature in one of the furnaces was creeping up. He observed festoons of slag hanging from the boiler tubes. Thus late he thought of the wizard powder and made up lost time by intensive feeding at the rate of 100 lb. (instead of 2½) per ton of coal, thereby adding $2.50 to the price per ton. By the time he had fed 6,500 lb. the weekend shut-down saved the situation. The slag did not fall off but it was thought to be softer than it might have been without the treatment.

THE TESTS were discouraging. There were too many variables to permit any conclusions except that operating vigilance was more effective than the lack of it plus wizard powder. If the powder should permit the use of a higher temperature, there would be profit in

COPPUS "BLUE RIBBON" VENTILATORS

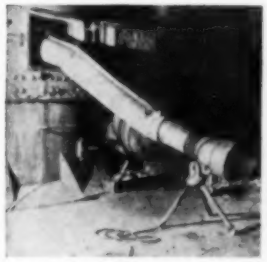
identified by the blue band

FOR WORKERS'

- *Safety*
- *Health*
- *Comfort*
- *Efficiency*

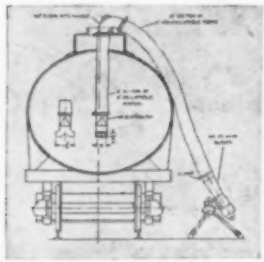
VANO Design "A" VENTILATOR

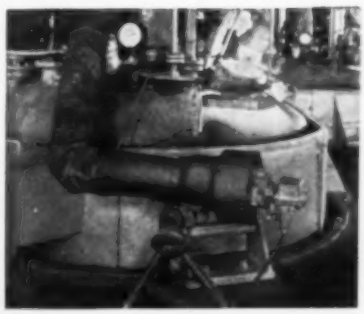
Vano Design "A" cooling interior of furnace, supplying fresh air through 10 feet of "Ventube" to provide safety and comfort during repair work.



Vano Design "A" delivering fresh air to cable manhole, expelling sewer gas, making entrance safe in a few minutes.

Vano Design "A" Ventilator plus a few accessories feeds large air volume into tank car, driving out fumes, stagnant or hot air for workers' safety and comfort.





Vano Design "A" supplying fresh air in Reactor Room of Synthetic Rubber Plant.

Vano Design "A" Ventilator supplying fresh air to men working in wing compartments, fuselages, etc.

Powered by a ½ hp motor, and equipped with the exclusive Coppus axial-flow propeller-type fan, this general-purpose blower delivers 1500 CFM of fresh air. It supplies ventilation for tanks, tank cars, drums, vats, underground cable manholes, pipe galleries, airplane wing compartments and fuselages, and other confined places. Weighs only 103 lbs. Uses 8"-diameter flexible canvas tubing ("Ventube").

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Vano Design "C" equipped with 8" discharge tubing removing welding fumes.

Vano Design "C" equipped with two suction lines removing welding fumes for operators' safety.

For withdrawing welding fumes from confined places or directly from the welding rod ... or for expelling fumes or hot air from enclosed vessels. You can get it with 8" suction inlet for 8" non-collapsible tubing ... or with multiple inlet nozzles for 5", 4" or 3" suction hose. The discharge outlet takes 8" "Ventube". Powered by a ½ hp motor, it weighs only 85 lbs.

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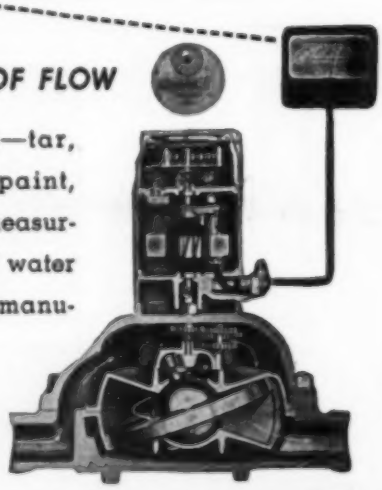

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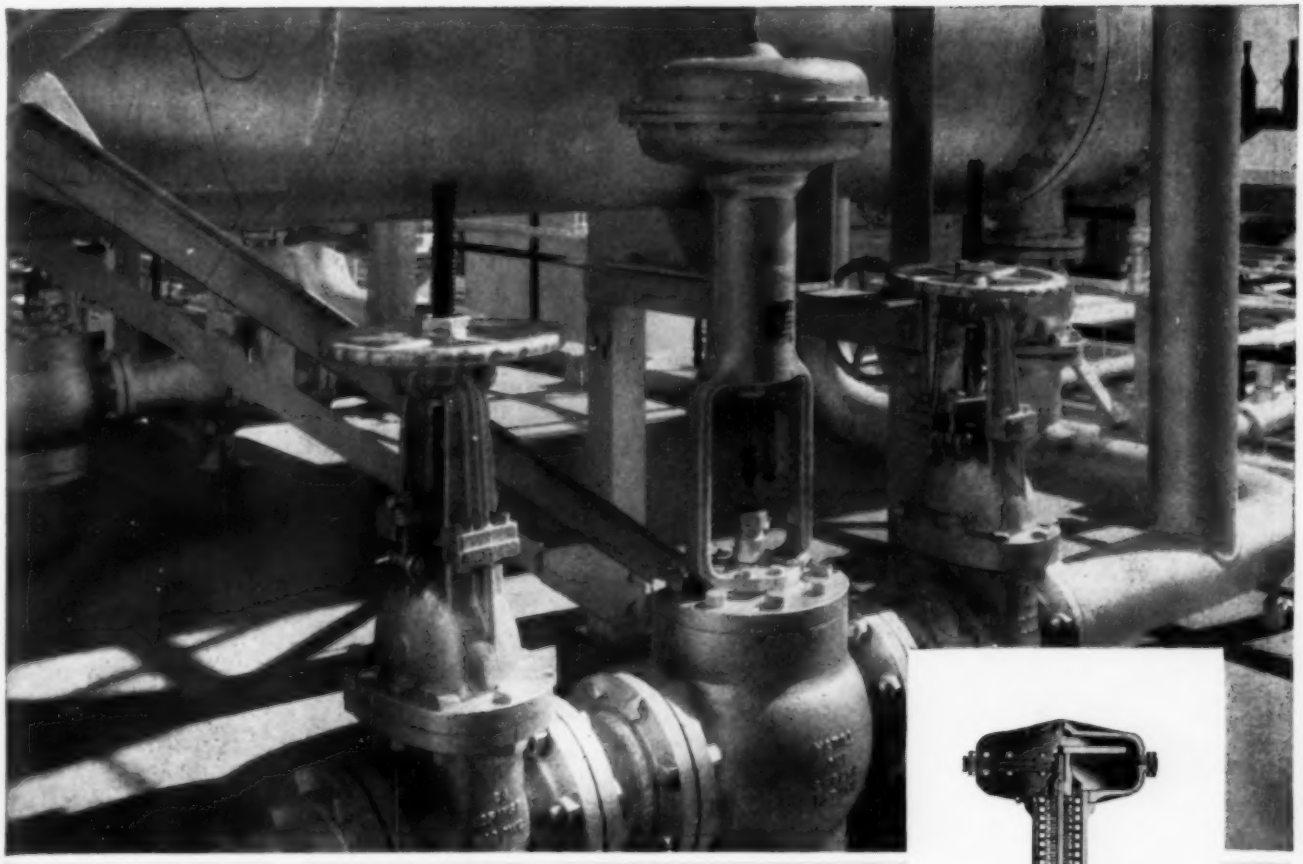
it but this was not established in our tests. However one more test was made using molybdenum ("molly-bedam" to the fireman). The importuning salesman explained that moly acted as a catalyst in vapor phase oxydation and hydrogenation of compounds in coal. At least it allayed the prejudice of chlorine in contact with the steel boiler. The moly was mixed with one pint of "coalcoate" oil at one oz. of MoS per pint of oil, the total cost being five cents. One pint of this oil mixture was sprayed on a ton of coal as it moved on the scraper conveyor to the bunker. There was a suspicion that this improved the coal's resistance to slagging. This may have been due to a quality change in the coal or to extra vigilance because of the presence of the Climax Molybdenum Co.'s research engineer. Such a test requires much time and patience and the evaluation of many qualifications. When moly went to war, testing ceased.

SENSITIVE CO_2 METERS are supplemented by steam-flow, air-flow meters. These meters have two pens recording respectively steam flow (red) and air flow (green). The steam flow is proportional to the quantity of fuel burned as is likewise the air flow. And the pressure of the gas in the furnace is proportional to the air flow through the setting. The air-flow pen is therefore a pressure recorder. The steam-flow pen produces a graph in red ink to record the flow of the steam from the boiler. The air-flow pen is adjusted by trial and error on the job so that its green graph rides over the red one when the CO_2 percentage is optimum for a given coal, as for example 14.6 percent for the stuff that Mac bought. If the CO_2 drops lower than 14.6 percent the green graph will be below the red and if the CO_2 exceeds the set figure, the green line will be above the red. The firemen regulate the air supply, and the corresponding pressure so as to bring the two graphs together. The instrument is adjustable for any desired CO_2 percentage.

THE SAME FURNACE which burned slag-infested coal with distress under the raw intelligence of the inexperienced firemen in 1932, cooperated in 1937 without offense. The conclusion was impregnated that there was no substitute for vigilance for avoiding slag. For convenience there were added some additional deslagging soot blowers and furthermore certain additional poke holes were provided to allow air lances to reach points where slag showed a tendency to start. Either the firemen or the slag wins according to which one gets there first. Even so, a wizard powder that would



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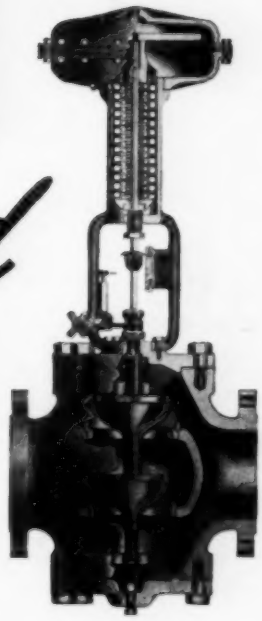

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TYPE H-86
DIAPHRAGM MOTOR VALVE

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- *PRECISE*

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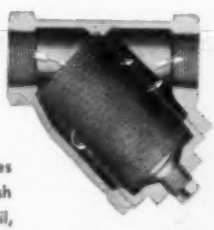
STRAINER
with
Monel Metal Basket



20 mesh screen (400 holes per inch) standard. 40 mesh special basket for fine oil, gas, gasoline and air. Write for Bulletin No. 128A.

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with Type H-140 Pilot

Wide throttling range—0 to 300%—or "snap" action. Size 6" diameter. Floats: 14" to 120". Working pressures 125 to 2500 lbs. Write for Bulletin No. 103.

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allow a high temperature for Mac's cheap coal would save a barrel of money.

AFTER MANY YEARS the operators believed that everything that can happen had happened and they developed a smug attitude. Then suddenly a new, mysterious circumstance caused so heavy a coating of slag as to almost shut down the boiler. It happened that the erector in his wisdom had used sheet steel for forms to retain the plastic refractory in an inaccessible place between the boiler tubes and the sidewall. Subsequent experience which plagued the operators proved that he should have used fire-soluble plywood. The sheet steel, weakened by long exposure to the fire, slipped down in patches and partially covered the tube that supplied the furnace pressure impulse to the steam-flow, air-flow meter. The fireman speeded up the draft fans to meet the fictitious pressure and plugged the inter-tube space with slag.

THE CORCORAN construction job in California was administered by Construction Engineer Walter Wayte and his assistant, one Lee Camp, a skinny product of Texas. A big bold pipe fitter weighing exactly twice as much as Lee applied a disparaging epithet which means fight in Texas. Lee's upper cut bounced off like a tennis ball from a stone wall but in his effort to dodge the big fellow fell flat into the soft concrete on the second floor. Adventitiously Wayte saw the performance and before the fitter could collect himself, Wayte rolled him out of the window. Then he cautioned Lee, "Never start a fight unless the gate receipts are guaranteed."

STANDARD ACCESSORY of a traffic cop south of the border is a screw driver. If he finds a car parked illegally, he removes the license plate.

THE ONLY SUGAR HOUSE that Captain Davidson ever built with his own money was the Dresden, Ontario, house (1902). He always had a million or two handy in case some plant fell into distress. The boarding house master who provided subsistance for the craftsmen at Dresden simplified his bookkeeping by issuing cards with 21 numbers in the perimeter which the steward punched out in exchange for meals. The card sold for $3.50 or 16⅔c. per meal. The retail price for those without cards was 25c. During the Captain's visits he borrowed Supt. Rudolph Stock's ticket so as to save the difference. Actually, however, he saved 25 cents as he had a poor memory.

NAMES IN THE NEWS

R. T. Major

W. M. Murray, Jr.

G. H. Young

Randolph T. Major has been elected vice-president and scientific director of Merck & Co., Inc., Rahway, N. J. Dr. Major was formerly director of research and development and is succeeded in that position by **Per K. Frolich**, who went with Merck in 1946 as coordinator of research.

R. Norris Shreve, professor of chemical engineering at Purdue University, will succeeds **John L. Bray** as head of Purdue's school of chemical and metallurgical engineering. Dr. Bray's retirement is effective September 1, after which he will devote his time to teaching and research as professor of metallurgical engineering.

Wilfred F. L. Place, who was chief of laboratory, Guayule Rubber Extraction Research Unit at Salinas, Calif., has joined the executive staff of The Durex Corp., New York.

H. W. **Rhodehamel** has been appointed executive director of Eli Lilly and Co. Other appointments recently announced are: **E. C. Kleiderer**, assistant director, biological division, in **Walden**, director, biochemical division; **H. A. Shonle**, director, organic chemistry division; **K. K. Chen**, director, pharmacology division; **W. A. Jamieson**, drector, biologcal division; **R. M. Rice**, director, medical division; **W. J. Rice**, director, chemical control division; **F. B. Peck**, associate director, medical division; **H. A. Dettwiler**, assistant executive director; **G. B.** charge of production.

William M. Murray, Jr., has been appointed assistant director of the Southern Research Institute at Birmingham, Ala.

C. G. Dandow, vice president, Johns-Manville Sales Corp. and general sales manager of the company's Industrial Products Division, has been elected to a 5-year alumni term membership on the Massachusetts Institute of Technology Corp.

Carl V. Fulkerson of Chicago has been appointed a field engineer for the U. S. Stoneware Co., Akron, Ohio.

Robbin Colyer Anderson, head of the department of chemistry in the University of Texas, has been elected chairman of the Central Texas Section of the American Chemical Society. Prof. Anderson succeeded Prof. Norman Hackerman of the same university.

Francis L. Ford, who resigned his position as research engineer with the Florence Stone Co. of Gardner, Mass., has accepted a position as chemical engineer with the M. W. Kellogg Co., New York.

Glen L. Allen, who has been on duty with the War Dept. as metallurgical consultant to General Headquarters staff of the Supreme Commander for the Allied Powers, returned to Washington, D. C., in June. While in Japan, Mr. Allen made a detailed study of the aluminum and magnesium industries of that country.

George H. Young, who during the past three years has been serving as executive assistant to the director of Mellon Institute, has been promoted to assistant director. Dr. Young joined the staff of the Institute in 1935 and has done most of his work in the field of organic polymers, particularly paints and coatings.

Raymond L. Phebus has joined the research laboratory of Carl A. Zapffe, consulting metallurgist of Baltimore, Md.

Frederick J. Bates, noted sugar physicist at the National Bureau of Standards, has retired after more than 43 years continuous service.

G. W. Wallace has been advanced to the position of superintendent in charge of the Freedom Refinery of the Freedom-Valvoline Oil Co. He has served the company for ten years as chief chemist in charge of developmental and refinery laboratories.

Budd E. Simonton has been appointed manager of the Oswego (N. Y.) Multiwall Paper Bag Plant of the St. Regis Paper Co. Before joining the company in 1945, he was associated with the Southern Advance Bag and Paper Co. and the Union Bag and Paper Corp.

Francis E. Murphy and **Henry G. Meyer** have been appointed assistant production managers by the Pennsalt Manufacturing Co. Mr. Murphy was formerly director of development at

THE THIEF
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Catalytic removal of objectionable sulfur compounds has been found to work great improvement in the leaded octane numbers of most gasolines. At the same time, "sour" distillates are "sweetened."

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Pennsalt's Whitemarsh Research Laboratories and Mr. Meyer was formerly assistant to the production manager.

A. E. Buchanan

Andrew E. Buchanan, Jr., has been named new head of the rayon technical division of E. I. duPont de Nemours & Co. following the retirement of **Ernest B. Benger.** Mr. Buchanan (a former assistant editor of "*Chem. & Met.*") was assistant manager of the division since 1944.

M. Couper

G. N. Reed

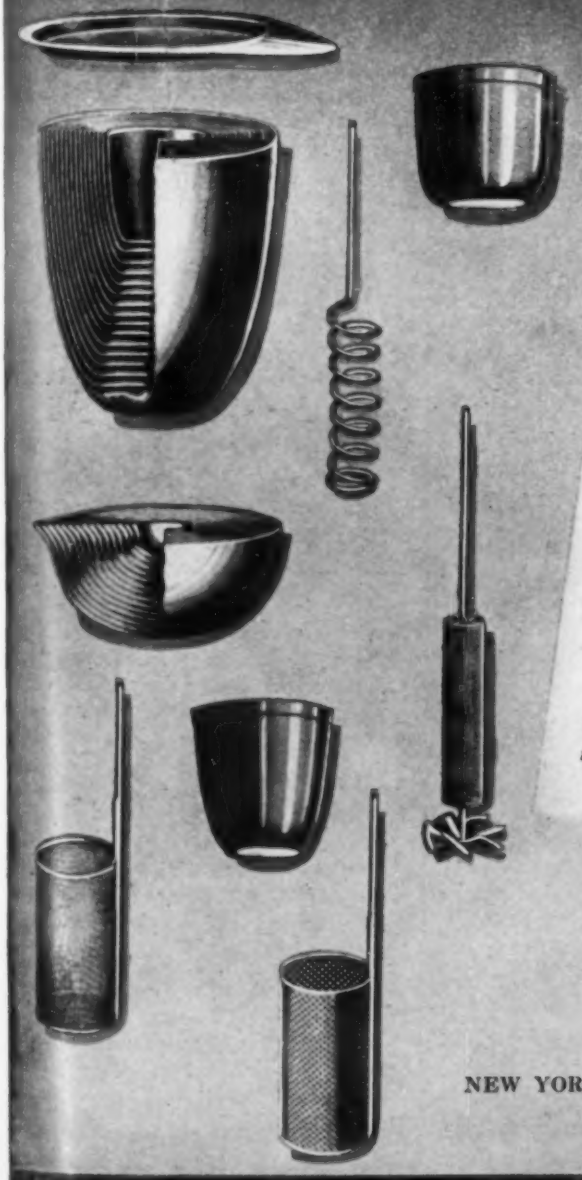
Monroe Couper, formerly research chemist with the DuPont Co., and **G. Nathan Reed,** formerly with the Experiment Station of Hercules Powder Co., have joined the staff of the Institute of Textile Technology, Charlottesville, Va., in the division of organic chemistry.

Richard W. French has been appointed assistant to the vice president and chief engineer, Standard Oil Co. (Ohio). Mr. French joined the company to take direct charge of the production department's staff organization.

Hugh A. Hamilton has been appointed technical director of General Mills, Inc.'s new Chemoil plant now under construction at Kankakee, Ill.

Geoffrey Broughton has been named professor of chemical engineering at Illinois Institute of Technology. The appointment is effective Sept. 1. A native of England, he came here in 1934 and is now at Rochester, N. Y.,

Baker Platinum Laboratory Ware



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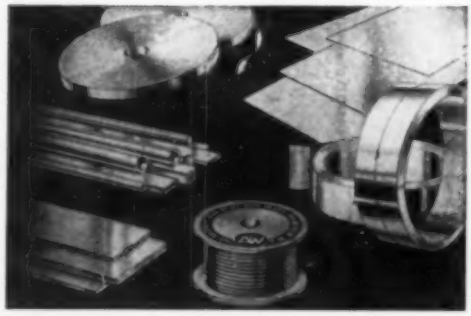
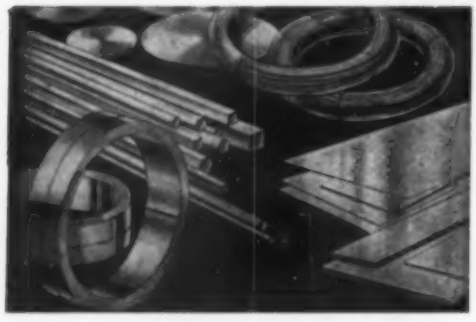


• SILVER •



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as assistant to the paper service department at Eastman Kodak Co.

H. W. Dahlbert, Jr. of the International Minerals & Chemical Corp., has been transferred to the Chicago office as executive assistant to the vice president of research, Dr. Paul D. V. Manning.

Joseph B. Farrell, who received his M.S. degree in chemical engineering at M.I.T. in February, has joined the staff of the Department of Chemical Engineering, University of Notre Dame, Ind., as instructor in chemical engineering.

Donald B. Keyes, vice president in charge of research and development, Hayden Chemical Corp., New York, received an honorary degree of doctor of engineering from Stevens Institute of Technology June 7.

H. W. Bevarly has been appointed to the post of assistant chief engineer, Votator Division, The Girdler Corp., Louisville, Ky.

R. Furrer

Rudolph Furrer has been elected vice president in charge of engineering for the American Car & Foundry Co. following the retirement of **Edmund D. Campbell.**

Ivan V. Wilson has been appointed assistant director of research for the Monsanto Chemical Co.'s Merrimac Division. Prior to this he was manager of the coating sales development department.

Clarence W. Coe has been made manager of the new Decatur, Ill., Works of the General Electric Plastics Division. He has been manager of the division's plant at Fort Wayne, Ind., operations of which will be transferred to Decatur.

J. R. Warford has been appointed special representative in the United States

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GUARDS AND PROTECTS THIS VALVE IN VIRTUALLY EVERY CHEMICAL SERVICE

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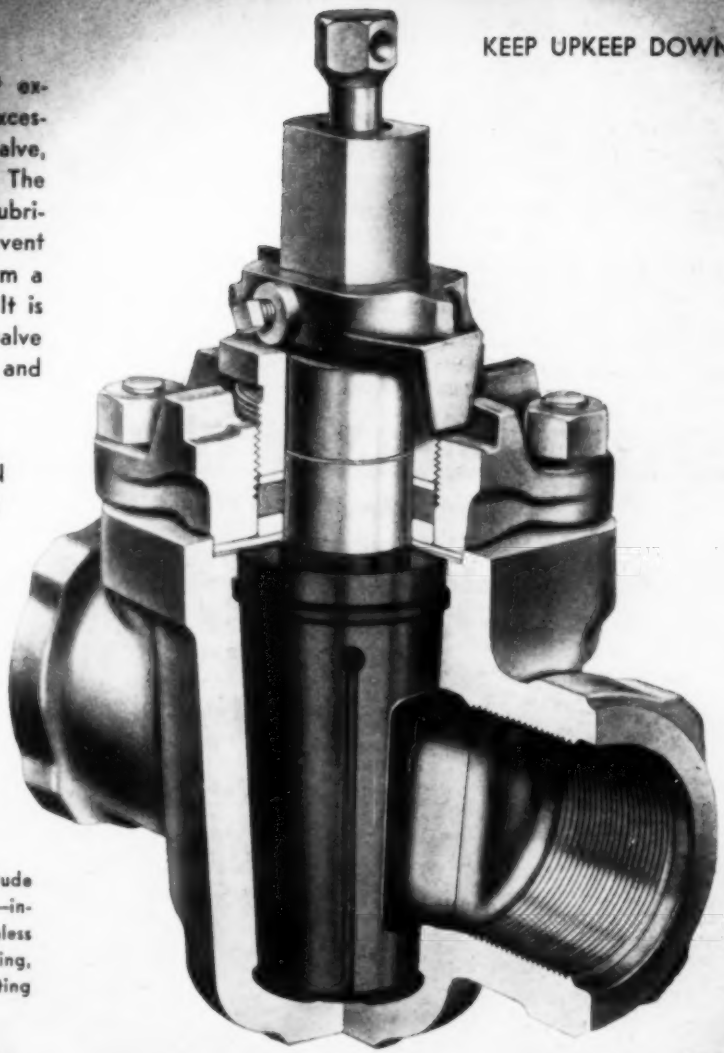
Where metal-to-metal movement exists, only lubrication will prevent excessive wear. In the Nordstrom valve, lubrication protects *at every turn*. The plug is encased in lubricant. The lubricant screw applies pressure to prevent the plug from galling and to form a positive seal around each port. It is obvious that the vital parts of the valve are fully protected against erosion and corrosion.



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. . . SEALS THE VALVE

. . . PREVENTS STICKING

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Chemical engineers are offered wide latitude in the specification of metals and alloys—including semi-steel, Nordco steel, stainless steel and bronze. Also Merchrome coating, a hard-facing on both plug and contacting body surfaces.

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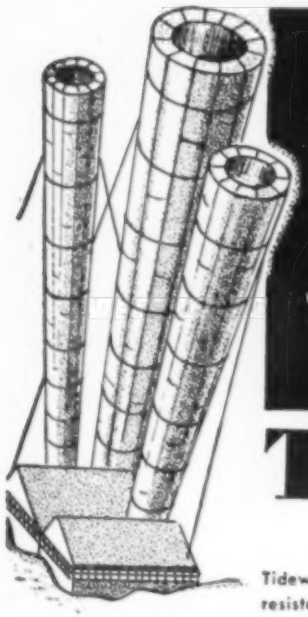

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to head a newly created wax section in the industrial products department of the Sun Oil Co. He was formerly managing director of two foreign marketing subsidiaries of the company. George W. Mock, technical representative for waxed products, will be associated with Mr. Warford.

Chester M. Alter of Boston University has been elected chairman of the Northeastern Section, American Chemical Society, for 1947-48. He succeeds **Prof. Chester P. Baker** of Northeastern University.

P. D. Caesar

W. C. Skinner

Philip D. Caesar, Paulsboro, N. J. and **William C. Skinner**, Dallas, Tex., have been named by the Socony-Vacuum Oil Co. as recipients of the company's first educational grants, under which they will receive full pay for the length of time necessary to earn degrees of doctor of philosophy at accredited schools of their choice. It is anticipated that an additional award of this character will be made each year henceforth.

G. Thomas Muehlenkamp has been named to the staff of Battella Institute, Columbus, Ohio, where he will be engaged in research on the engineering properties of materials. Previously Mr. Muehlenkamp has been associated with the Wright Aeronautical Corp. and with the University of California.

H. B. Paul, chemical engineer with Atlas Powder Co., has been assigned as technical representative of the industrial chemicals department for the New England district. **L. G. Parkinson** has been assigned to serve in the same capacity in the Midwest.

William G. Coppins has been named to the research staff in the division of analytical chemistry of Battelle Institute, Columbus, Ohio. He was formerly with the Universal-Cyclops Steel Co.

Helmut Wakeham has joined the staff of the Institute of Textile Technology, Charlottesville, Va., to work in the division of physical chemistry. He has formerly been associated with the Standard Oil Co. of California and

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Morris B. Jacobs has been designated chief organic chemist, Research Laboratories, Bureau of Laboratories, Dept. of Health, City of New York.

Murray E. Othmer, since 1940 on the Chemical Engineering staff of Tufts College, has been appointed visiting professor of chemical engineering at the University of Puerto Rico. Professor Othmer, who has been active in Latin American chemical engineering service, recently returned from China, where he worked with the Chinese government on industrial projects in Hunan Province.

A. C. Dreshfield

Arthur C. Dreshfield has resigned as technical director of H. P. Smith Paper Co. to establish a consulting practice in the paper and related industries, with headquarters at 401 W. Elm Ave., LaGrange, Ill.

J. Forrest Allen, recently awarded a Ph.D. degree in organic chemistry from Ohio State University, has joined the research staff at the South Charleston Div. of Westvaco Chlorine Products Corp.

Lester A. Pratt, general sales manager of the Merrimac division of the Monsanto Chemical Co., Everett, Mass., has been appointed assistant to the division general manager and also has been named president, general manager and trustee of the New England Alcohol Co., a subsidiary of Monsanto. **Frederick S. Hatch** has been named vice president of the latter. **Howard J. Heffernan** succeeds Dr. Pratt as divisional general sales manager.

J. M. Graham, Jr., formerly assistant director of the Monsanto Chemical Co.'s general development department has joined the general engineering department as manager of the process.

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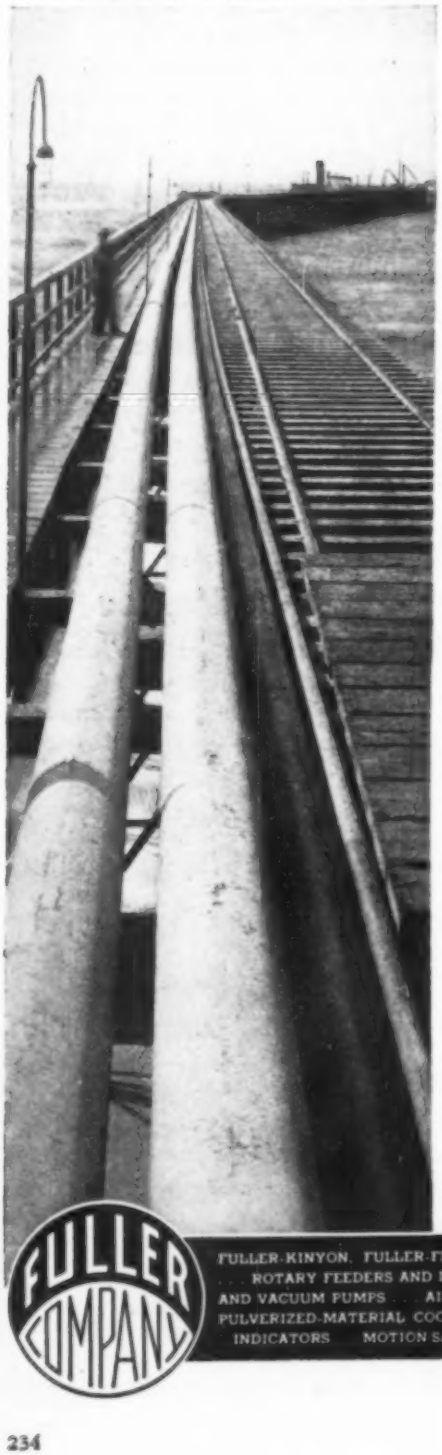

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Simplicity. Compare this simple conveying pipe line, 3600 feet in length, (through which cement is transported from storage to ship hold) with any straight-line, mechanical layout with its many ramifications and working parts.

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Low operating costs. No multiplicity of parts requiring frequent attention and replacement. Only one moving part, the screw in the pump, which can be replaced with a minimum lose of time.

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P 82

H. T. Gammon has returned to his former post as manager of the project analysis section.

Thomas Coyle, manager of the Du Pont company's chlorine products division has retired. C. B. Sheperd, now manager of the solvents division, has become manager of both divisions.

Arthur B. Hersberger, divisional director of research and development of the Atlantic Refining Co., has been elected chairman of the Philadelphia Section of the American Chemical Society for 1947-1948.

H. A. Campbell

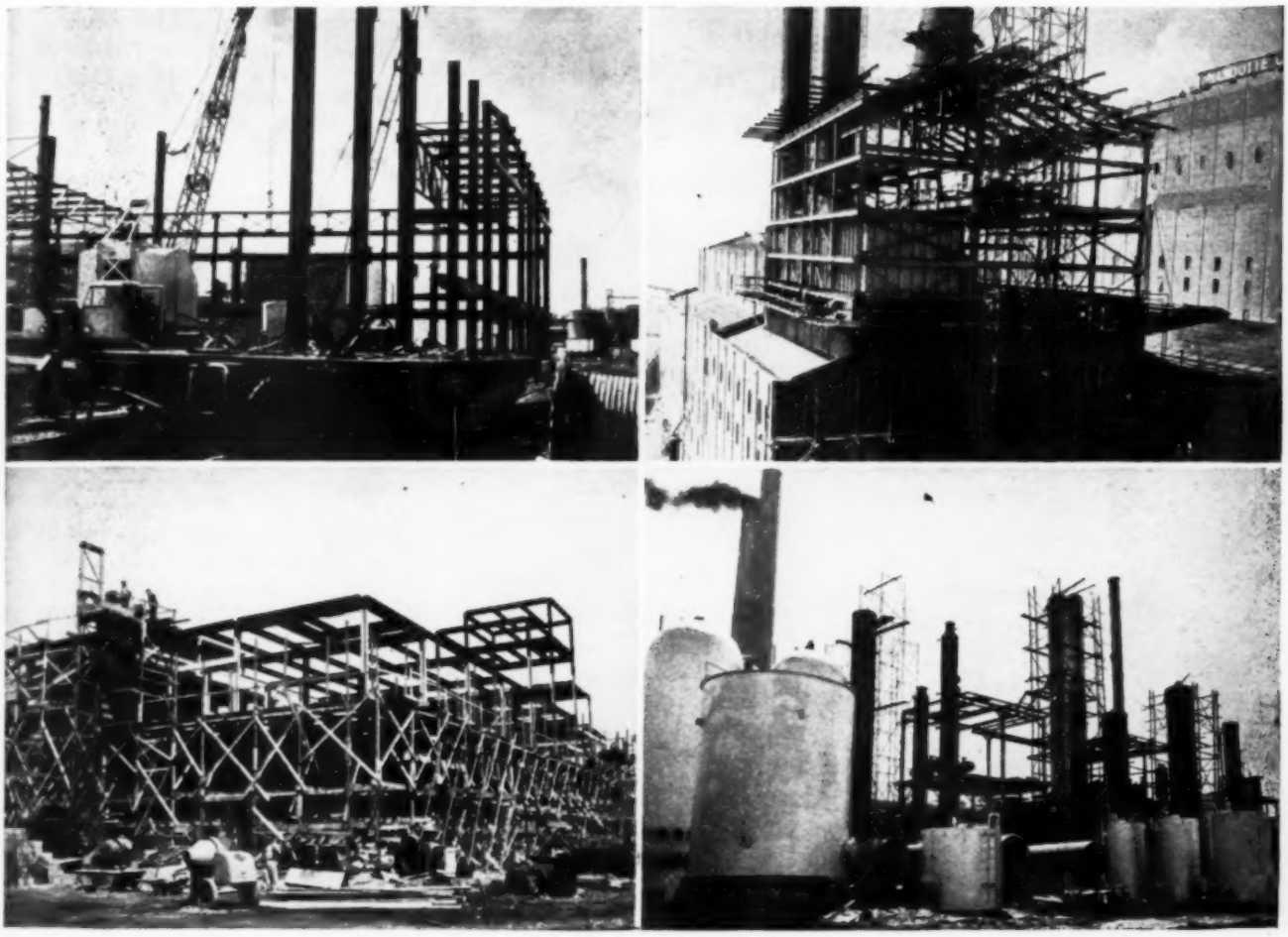
Harry A. Campbell, chief inspector, Bureau of Explosives, Association of American Railroads, New York, N. Y., has been awarded the 1946 Morehead Medal by the International Acetylene Association for service to the safe and efficient packaging and shipment of acetylene.

Ian D. Patterson, who has been with the Goodyear Tire and Rubber Co. for more than 27 years, has been named manager of the development department and **Murrell J. DeFrance,** who has been in the service of the company for 18 years, has been promoted to assistant manager. The two men will supervise development work on compounding, adhesives and coatings, Pliofilm packaging, and other chemical product activities.

Andrejs Dravnieks, trace analyst in the research department of the Chicago offices of the Continental Can Co., has been named research associate on a Navy-sponsored corrosion research project at Illinois Institute of Technology.

Carl J. Lamb has resigned as vice president of Hydropress, New York, N. Y., to join D. M. McBean, consulting engineer of Rochester and Chicago, as an associate. During his 30 years of engineering experience Mr. Lamb ha

OPERATION SUPPLY



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Production from our Chlorine Plant No. 3, on which construction is under way, is scheduled for early next year.

In order to produce more alkalies in future months, we are doing everything possible to rush the completion of these plants. But it's a big job—one which requires thousands of intricate and massive "tailor-made" parts and equipment. So it takes time.

An addition to our North Plant Power House is progressing on schedule.

We also expect to complete our new Synthetic Detergent Plant, for which the building is almost ready, by the end of 1947.

Our new glycol plant, which will provide a wide variety of industries with this vital chemical, will soon be in production.

Meanwhile, with the tremendous demand for essential chemicals far exceeding our production capacity, we are allocating available supplies with the utmost fairness to our present customers.

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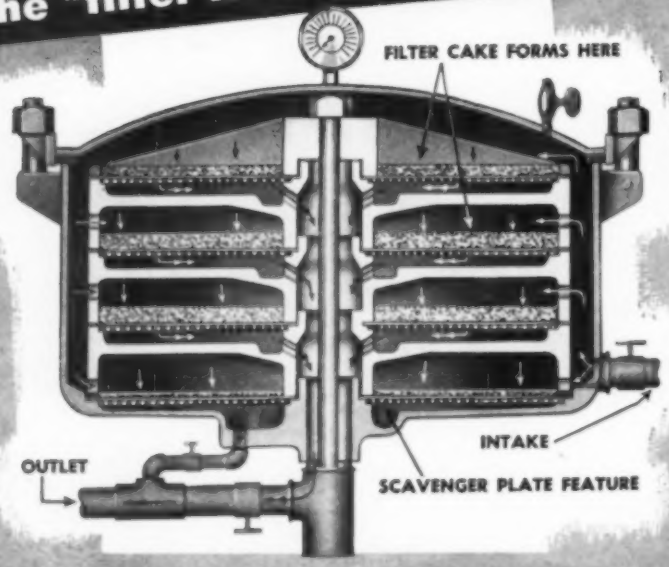
makes SPARKLER

the "filter that filters all liquids"



SPARKLER

horizontal plate

FILTERS

. . . here's the story:

A FEW OF MANY PRODUCTS THAT CAN BE FILTERED WITH SPARKLERS

Acids
Alcohols
Alkalis
Beverages
Candy scrap
Caustics
Chemicals
Cleaning fluids
Extracts
Flavors
Gums
Hydraulic fluids
Lubricants
Milk
Molasses
Oils
Pharmaceuticals
Plating solutions
Resins
Shellacs
Soap, liquid
Syrups
Varnishes
Water
Wines

★ Sparkler Horizontal Plate Filters handle any liquid from heavy varnishes to light alcohols.

★ Equally efficient performance on intermittent or continuous operation, under a wide range of temperature, pressure and viscosity conditions.

★ Equally effective whether removing carbons and contact clays or clarifying and polishing with filter aids.

★ Patented Scavenger Plate permits *complete* batch filtration. (It's virtually an auxilliary filter with an independent control valve.)

★ Unexcelled filter cake stability — no slipping or breaking.

. . . why?

Because filter media are supported on a horizontal plane and filter aids floated into position uniformly; filtration takes place uniformly over entire filtering areas. Flow through filter is always *with* gravity.

Sparkler Filtration Is *Engineered* Filtration—we invite correspondence on your problem. You will receive the advice of filtration scientists with a quarter of a century of experience in a specific field.

SPARKLER MANUFACTURING COMPANY

MUNDELEIN, ILLINOIS

been with Westinghouse Electric Corp., E. I. Dupont de Nemours & Co. and Sinclair Consolidated Oil Co.

Adrian D. Joyce, chairman of the board of the Glidden Co., was recently awarded an honorary Doctor of Engineering degree by the Case School of Applied Science in Cleveland.

Ira D. Garard, head of the chemistry department of the New Jersey College for Women, has been elected chairman of the North Jersey Section of the American Chemical Society.

Harry R. Scott has been appointed Chief Engineer for the Curtis Bay plant of the Davison Chemical Corp. Mr. Scott will coordinate and supervise all engineering activities at that plant. **J. Walter Lautenberger** will be plant engineer and **John E. Harvey,** industrial engineer, with **E. M. MacDonald,** superintendent of maintenance.

Alvin C. Peterjohn, associated with the rubber industry for the past 30 years, has been appointed technical director of the C. P. Hall Co., Akron.

Vanderveer Voorhees has been elevated to the rank of senior patent attorney by the Standard Oil Co. of Indiana.

Bedford Berry has accepted a position with the Advertising Division of the Du Pont Plastics Dept., Arlington, N. J. He was formerly with the Hercules Powder Co.

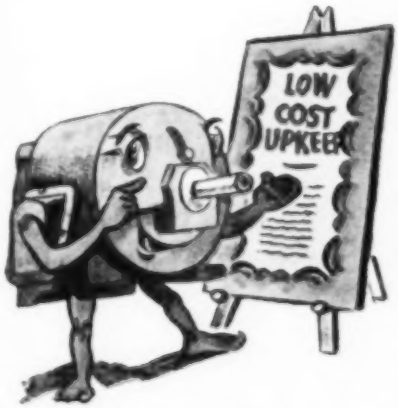
Everett G. Ackart has been awarded the Newcomen medal for his work in designing steam plants, especially those for the manufacture of smokeless powder. Mr. Ackart has recently retired from his position as chief engineer of the E. I. du Pont de Nemours Co.

E. R. Queer and **E. R. McLaughlin** have been retained by the Pittsburgh Lectrodryer Corp., Pittsburgh, Pa., as consulting engineers.

Howard J. Smith has joined the research staff (Chemical Division) of The Titanium Alloy Manufacturing Co. as a senior chemist. Before coming to the Niagara Falls, New York plant, Mr. Smith served as chief chemist of Joliet Chemicals, Joliet, Ill.

E. E. Stansbury will this fall join the staff of the Department of Chemical Engineering of the University of Tennessee as Associate Professor. Dr. Stansbury will have the primary responsibility for developing graduate courses in metallurgy to be given both

"Puzzled over which type of motor to buy?"



In 80% of the Cases, open squirrel-cage induction motors meet the need. They fit most drives, and can be obtained in numerous standard and special designs to meet varying conditions of starting torque, slip, etc. They are also the most economical type to buy and to maintain. Allis-Chalmers builds induction motors in sizes from ½ to 10,000 hp — or higher, if needed.

For Tough Starting Conditions, wound-rotor induction motors are recommended. Their high starting torque, at comparatively low starting current, and their controllable speed characteristics are desirable in drives for conveyors, grinding mills and other tough starting assignments. Compact, accessible Allis-Chalmers wound rotor induction motors range in size from 5 to 10,000 hp.

For Slow Speed, direct-connected drives as low as 75 rpm, or other constant speed applications at higher rpm, synchronous motors are a good solution. They are of particular benefit when a system's power factor is low, since they can be furnished for operation at either unity or leading power factor. From 40 hp to 50,000 hp and higher — in bracket bearing, pedestal bearing, or engine types.

Is d-c Available? Then adjustable speed operation is easily obtainable. Allis-Chalmers builds d-c motors from ½ to 10,000 hp and higher — for constant or adjustable speed duty in ranges of 6:1 and lower. By means of a source of d-c voltage, adjustable speed motors may also be designed to operate over a speed range as high as 30:1. Suitable for fans, elevators, etc.

Select from the Complete Allis-Chalmers Line!

NOT JUST FOLLOWING popular choice and using a standard squirrel cage induction motor. But the *right* motor for economy and efficiency.

That means an overall knowledge of *all* types of motors . . . their operation . . . limitations . . . maintenance. And there's where your A-C representative can be a big help. His recommendations are backed by experience . . . and the Allis-Chalmers motor he selects is *itself* backed by 50 years of experience in motor design and building. ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 2304

1847 1947 A CENTURY OF SERVICE to Industry THAT MADE America Great

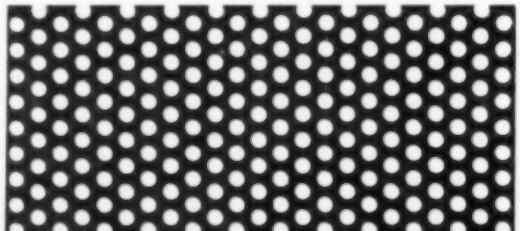
ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment-
Biggest of All in Range of Industrial Products

To Reduce
HIGH
PRESSURES
to
LOW
PRESSURES
Reduce pressure as high as 2,500 pounds down to working pressures with an ALL BRONZE CASH-ACME Type LS Pressure Reducing Valve. Nitralloy trim for longer service is standard.
Pipe size ⅜", ½", ¾".
★ See your Mill Supply dealer——— ask for CASH-ACME Automatic Valves.
D12 Catalogue available on request.
Manufacturing SPECIALISTS OF
STOCK—CATALOGUE—SELL CASH-ACME Products.
CASH-ACME
Automatic PRESSURE CONTROL VALVES
A.W. CASH VALVE MFG. CORP.
6612 EAST WABASH AVE.
DECATUR ILLINOIS

For processes requiring

★ CORROSION-RESISTANT ★ SCREENS ★



In many chemical processes corrosion-resistant screens are highly desirable, and for such operations Hendrick furnishes perforated plate of stainless steel, Monel, Everdur, or bronze, in any required shape and size of opening.

Hendrick also makes many types of screens for special applications, such as screens of perforated sheet lead and milled-slot screens for centrifugal dryers. Write for full information on whatever type of screen is needed for your work.

SEE OUR CATALOG IN SWEET'S

HENDRICK
Manufacturing Company
51 DUNDAFF STREET, CARBONDALE, PENNA.
Sales Offices In Principal Cities

Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Armorgrids

at the Knoxville campus and in the University's graduate program at Oak Ridge.

Irving Beiley has been appointed assistant to the president of Colloids, Inc., Newark, N. J. He recently completed the design of a chemical condiment plant for Edelbrew Brewery, Inc. of Brooklyn, N. Y.

James P. Margeson, Jr., has been elected executive vice president of International Minerals & Chemical Corp., Chicago. He was formerly vice president in charge of the mining and distribution of potash.

Frank J. Smith has been transferred to New York by the Pan American Refining Corp. to head the company's chemicals division.

OBITUARIES

Michael Joseph Callahan, 57, manager of the Fabrics Division of the Fabrics and Finishes Department of the DuPont Co., died June 25 at Wilmington, Del.

Harry Seltz, 51, professor of physical chemistry at Carnegie Institute of Technology, died June 19 at his home in Fox Chapel, Pa., after a brief illness.

Ralph A. Jacobson, 51, a research chemist in the Chemical Department of the DuPont Co., died July 2, at Wilmington, Del.

Worthen E. Brawn, 53, of Pejepscot Paper Co., Brunswick, Maine, and president of TAPPI, died aboard the Queen Elizabeth on his way to visit paper mills in Europe.

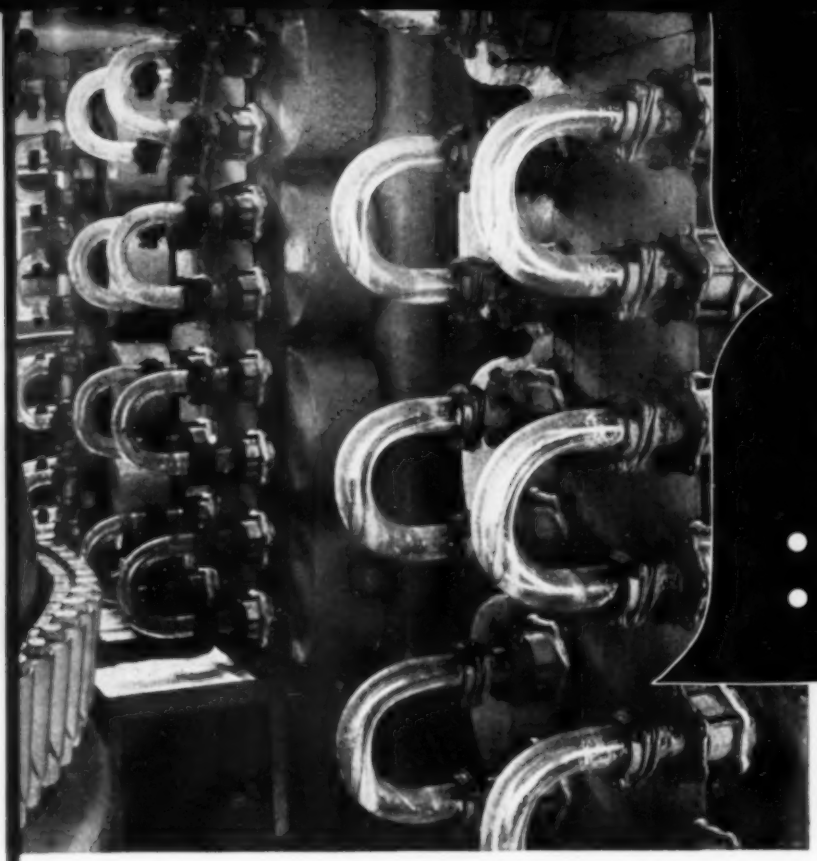
William Porter, 47, of Rumford, R. I., and chief engineer of Rumford Chemical Works, died suddenly July 21 while vacationing on Cape Cod.

Lee Showers, 68, a retired executive of the Pittsburgh Plate Glass Co., died June 16 at his Kittanning, Pa., residence.

Clark M. Osterheld, vice president and general manager of the Clark Water Heater division of the McGraw Electric Co., Chicago, died July 6 in Madison, Wis., after a short illness.

Herbert H. Meyers, vice president of Virginia Carolina Chemical Corp., Richmond, Va., died May 12 at his home in Richmond after a brief illness.

Percy Parrish, 62, well known British chemical engineer, died May 30 after a short illness at his home in England.



with

PYREX brand Glass Pipe . . .

- *FEWER PRODUCTION STOPS*
- *FEWER REPLACEMENTS*

Hoffmann-LaRoche, Inc., Nutley, New Jersey, selected PYREX brand glass pipe as the ideal corrosion-resistant, non-contaminating material for sensitive liquids carried in pipe lines. The installation shown is used for the recovery of ampul alcohol in a Vitamin B_1 process.

The excellence of pharmaceuticals manufactured by Hoffmann-LaRoche, Inc., Nutley, New Jersey, is known throughout the world. Throughout its plants, extensive use is made of PYREX brand glass pipe to assure product purity since PYREX pipe remains impervious to hydrochloric acid which is used in the refinement of many sensitive pharmaceuticals.

From an engineering standpoint, PYREX brand glass pipe also has been found economical to use wherever possible. Because of the visibility it provides, fewer production stops are necessary. Because of its composition, fewer piping replacements are needed. There is never any question about solvent reaction on piping or vice versa.

The use of PYREX pipe is growing constantly because it has proved such a practical plant material. When pipe line corrosion or product contamination are important factors, PYREX pipe and fittings will make possible increased production of better products at lower costs.

PYREX pipe is available in diameters of 1″, 1½″, 2″, 3″, and 4″ in lengths up to 10 ft. Fittings of similar sizes are available in the form of elbows, tees, return bends, reducers, crosses, etc.

TRY A TEST INSTALLATION OF PYREX PIPE IN YOUR TOUGHEST PROCESSING SPOT!

At relatively small cost you can test the practicality of PYREX glass pipe in meeting your toughest requirements. Why not try a test installation now?

CORNING GLASS WORKS
CORNING, NEW YORK
SALES OFFICES: NEW YORK • CHICAGO • SAN FRANCISCO

CORNING means research in GLASS

T.M. REG. PYREX U.S. PAT. OFF.

PYREX GLASS PIPE
BRAND

CORNING GLASS WORKS, DEPT. CE-8, CORNING N. Y.
Please send me Bulletin 1A-3 describing PYREX brand pipe.
NAME ..... TITLE .....
COMPANY .....
ADDRESS .....
CITY ..... ZONE ..... STATE .....

TECHNICAL PRODUCTS DIVISION: GLASS PIPE • LABORATORY GLASSWARE • GAUGE GLASSES
LIGHTINGWARE • SIGNALWARE • OPTICAL GLASS • GLASS COMPONENTS

Speed your
FLOOR-TO-FLOOR
MATERIALS HANDLING
WITH THIS
STREAMLINER
30° INCLINED
BELT CONVEYOR

This Streamliner operates either up or down at a constant speed of 45 feet per minute. "SET HIGH", it handles over-sized packages; "SET LOW" smaller packages can be handled within the protective guard rails. Unit is equipped with durable rough top rubber belt . . . is made in standard widths up to 30" . . . has manual take-up for belt slack . . . may be provided with free-rolling casters for portability . . . or can be supported from one floor.

Write for detailed information.

HARRY J. FERGUSON CO.
WHEEL • PORTABLE BELT • BELT AND ROLLER GRAVITY CONVEYORS
117 WEST AVE., JENKINTOWN, PENNA.

INDUSTRIAL NOTES

Wyssmont Co., Long Island City, N. Y., has appointed C. J. Hunter of Holbrook & Hunter and D. D. Foster of D. D. Foster Co., as its representatives in the Boston and Pittsburgh areas respectively.

E. I. du Pont de Nemours & Co., Wilmington, has placed Carl I. Taber in charge of its newly formed fabric development section of the Nylon division.

Pennsylvania Salt Mfg. Co., Philadelphia, has selected Joseph J. Duffy, Jr., as manager of sales for the special chemicals division. He succeeds William P. Drake, recently appointed assistant vice president.

Babcock & Wilcox Co., New York, announces that on July 1, G. J. Hartnett, Jr., became superintendent of planning and N. Nielsen superintendent of production. Both changes are at the company's plant in Barberton, Ohio.

Continental-Diamond Fibre Co., Newark, Del., has moved Harry M. Dexter from Cleveland to the main office where he will serve as sales manager.

Globe Steel Tubes Co., Milwaukee, has made T. R. Coffey manager of sales at its office in Detroit.

Pan American Petroleum & Transport Co., New York, has purchased the refinery of Stone Oil Co. at Texas City, Tex. Pan American had operated the refinery for the last four years on a leased basis.

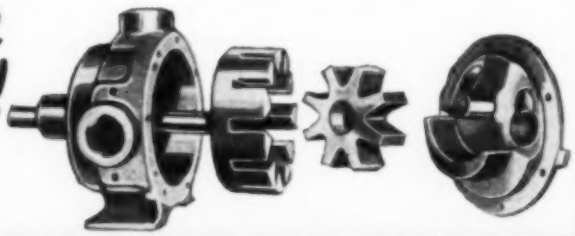
Link-Belt Co., Chicago, has appointed Warren H. Maxwell general superintendent and Robert C. Becherer plant manager of the Ewart plant in Indianapolis.

H. K. Porter Co., Inc., Pittsburgh, has promoted Harold A. Hintz to the position of Pacific Coast sales manager with headquarters in the Petroleum Bldg., Los Angeles. J. F. Morley is now district sales engineer with offices in the Monadnock Bldg., San Francisco.

Julius Hyman and Co., Denver, Colo., has opened a western sales office at 9 Main St., San Francisco with Edward Degginger in charge.

Clarostat Mfg. Co., Brooklyn, has added C. W. Henderson to its staff

Here's the Works! ...in



VIKING ROTARY PUMPS

Simple to the nth degree. Just 2 moving gears—one within the other. Both self supported. Positive in action. Smooth, even flow with no pulsation. Handles any clean liquid regardless of viscosity. Low speed. Full, fast delivery. Long life. Complete line of models and sizes with pressures ranging from 5 to 500 psi. depending on style of pump.

If it is your job to see that liquids are moved, see Viking for the answer. Write today for the folder that will help you 47SC.

See Our Catalog In SWEETS

VIKING Pump COMPANY
CEDAR FALLS, IOWA

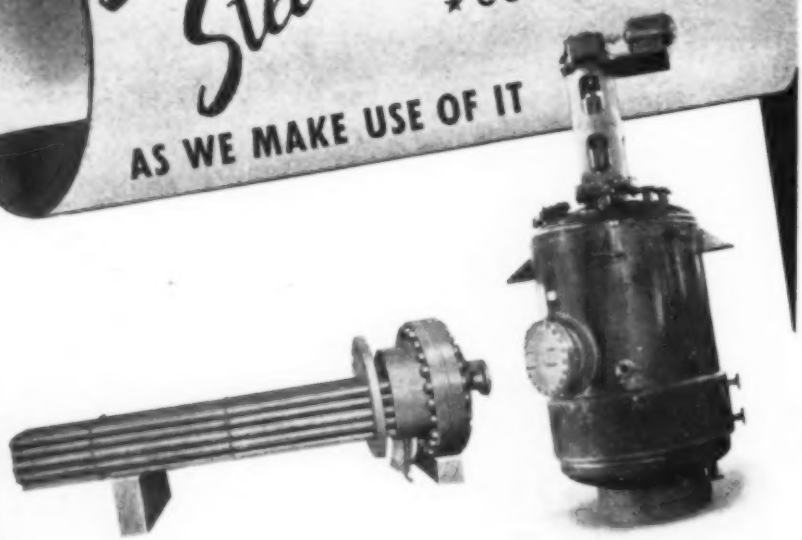
NEVILLE
... a mark of quality and service
COUMARONE RESINS
ALKYLATED PHENOL RESINS
PLASTICIZING OILS
COAL-TAR SOLVENTS AND OILS
NEUTRAL AND SHINGLE STAIN OILS
RUBBER RECLAIMING OILS
CHEMICAL SPECIALTIES
THE NEVILLE COMPANY
PITTSBURGH, 25, PA.
Chemicals for the Nation's Vital Industries

A-25

PATTERSON-KELLEY
Heat Transfer EQUIPMENT

Stainless Steel
AS WE MAKE USE OF IT

★ KETTLES
★ HEAT EXCHANGERS
★ COOLERS
★ AUTOCLAVES
★ COOKERS
★ CONDENSERS



We have two experiences to offer in connection with your requirements along the above lines: (1) many years of experience in the design and construction of many types of heat transfer equipment; and (2) many years of experience in working with the stainless steels as used for such equipment.

Our engineers will be glad to work out the proper design of equipment to meet your requirements or help your engineering staff in any way if you prefer to do your own designing.

PATTERSON-KELLEY
Heat Exchangers
AND
Process Equipment

EST 1880

THE PATTERSON-KELLEY *Company, Inc.*
109 WARREN STREET, EAST STROUDSBURG, PA.

NEW YORK 17—101 Park Ave. PHILADELPHIA 3—1700 Walnut St.
CHICAGO 4—Railway Exch. Bldg. BOSTON 16—96-A Huntington Ave.

Representatives in Principal Cities

in the capacity of sales engineer in the Philadelphia area.

Hardinge Co., Inc., York, Pa., has moved its district office in San Francisco to 24 California St. G. A. Wallerstedt is district manager.

Joseph Turner & Co., Ridgefield, N. J., will act as distributor of denatured alcohol manufactured by Clarke Distilleries, Ltd. Offices of Clarke Distilleries are in Boston and the producing plant is in Caribou, Maine.

Minneapolis-Honeywell Regulator Co., Minneapolis, has formed its sixth foreign subsidiary, Honeywell-Brown S. A. Headquarters are in Mexico City, Mexico, and Virgil H. Hiermeir is manager.

Reheis Co., Inc., Newark, N. J., has added Thomas Govett to its staff in the capacity of vice president and technical director.

Stein, Hall & Co., Inc., New York, has placed Kenneth Arnold in charge of its Chicago sales branch. Oscar Westerlund will continue as assistant manager of the branch.

Fisher Governor Co., Marshalltown, Iowa, has appointed G. W. Beecroft & Co., Toronto, as representative for the Province of Ontario.

Kennametal Inc., Latrobe, Pa., has appointed Lundwall & Co., V. Hamngatan 5, Goteberg, as distributing representative in Sweden.

Goodyear Tire & Rubber Co., Akron, has named J. H. Conrad manager of Pliofilm convertor sales. He succeeds J. C. E. Williams who is now manager of the Pliofilm department of the company's subsidiary which operates in foreign markets.

Owens-Illinois Glass Co., has transferred R. W. Rogers to the industrial and electronics division of Kimble Glass Co. where he will serve as sales manager.

National Starch Products Co., New York, has added Leo T. Slattery and John C. McCauley to its sales staff. Mr. Slattery is located in Chicago and Mr. McCauley in Philadelphia.

Bemis Bro. Bag Co., St. Louis, has appointed O. S. Brock manager of its subsidiary, the Indianapolis Bleaching Co., Indianapolis.

Aldo Chemical Corp., 33 Union Square, New York, has been formed to engage in the manufacture and sale

Only the SIDE of a V-Belt TOUCHES the Pulley

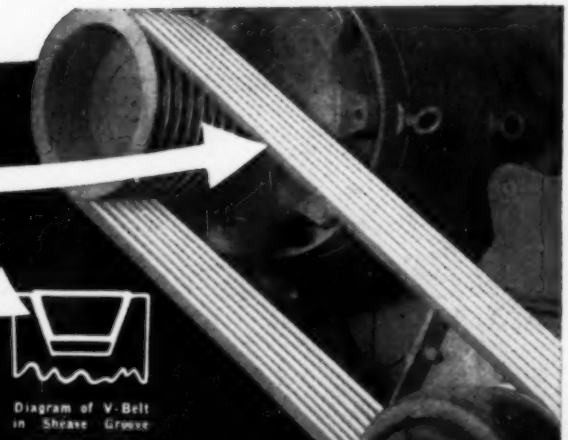


Diagram of V-Belt in Sheave Groove

The SIDE Does ALL the Gripping--
----Naturally it GETS the WEAR!

Every ounce of load a V-Belt *carries* must first be picked up by the sides of the belt. Clearly so, because *only* the *sides* touch the pulley! The sides do all the GRIPPING—they get all the WEAR against the sheave-groove wall. The sides pick up the load. They transmit that load to the belt as a whole. And then, once more, the sides—and the sides alone—grip the driven pulley and deliver the power to it.

No wonder you have always noticed that the sidewall of the *ordinary* belt is the part that *WEARS OUT FIRST.*

Now See How the Patented CONCAVE SIDE
* SAVES Sidewall Wear and Lengthens Belt Life!

Naturally, since the sidewall is the part that wears out first, anything that prolongs the life of the sidewall will lengthen the life of the belt.

The simple diagrams on the right show exactly why the ordinary, straight-sided V-Belt gets excessive wear along the *middle* of the sides. They show also why the Patented Concave Side greatly reduces sidewall wear in Gates Vulco Ropes. That is the simple reason why your Gates Vulco Ropes are giving you so much longer service than any straight-sided V-Belt can possibly give.

*Longer Sidewall Wear is MORE IMPORTANT NOW Than Ever Before!

Now that Gates *SPECIALIZED* Research has resulted in Super V-Belts capable of carrying much heavier loads—up to 40% *higher horsepower ratings* in some cases—the sidewall of the belt is called upon to do even more work in transmitting these heavier loads to the pulley. Naturally, with heavier loading on the sidewall, the life-prolonging Concave Side is more important NOW than ever before!

The CONCAVE SIDE is a GATES PATENT

Straight Sided V-Belt

Fig. 1

How Straight Sided V-Belt Bulges When Bending Around Its Pulley

Fig. 1-A

You can actually feel the bulging of a straight-sided V-Belt by holding the sides between your finger and thumb and then bending the belt. Naturally, this bulging produces excessive wear along the middle of the sidewall as indicated by arrows.

Gates V-Belt with Patented Concave Sidewall

Fig. 2

Showing How Concave Side of Gates V-Belt Straightens to Make Perfect Fit in Sheave Groove When Belt Is Bending Over Pulley.

Fig. 2-A

No bulging against the sides of the sheave groove means that sidewall wear is evenly distributed over the full width of the sidewall—and that means much longer life for the belt!

478

THE GATES RUBBER COMPANY, DENVER, U. S. A. "World's Largest Maker of V-Belts"

GATES VULCO ROPE DRIVES

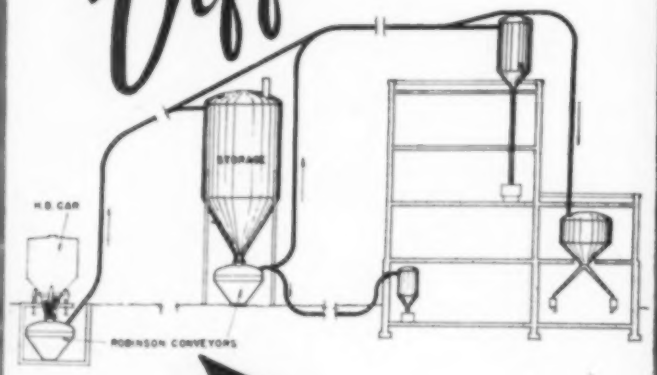
Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U. S. and 71 Foreign Countries

Gates

THE MARK OF SPECIALIZED RESEARCH

ROBINSON *Air-Activated* CONVEYOR

THE PNEUMATIC CONVEYOR THAT'S *Different*



"*Floating*" Material Through a Pipe is Better Than Blasting It Through

"*Floating*" It Through May Be Better Than Handling It Mechanically

WE are referring to the handling of dry, finely granular or pulverized materials in bulk into, through or out of the plant.

We are also referring to the unique way the material in the Robinson System is "fluffed" up into a cloud and then quickly conveyed through piping to its destination. The action might be likened to the flow of a liquid through a pipe. It's unique in pneumatic conveying methods.

Not only is the Robinson Air-Activated System already in use in many processing plants but within the past year it has been installed or ordered for handling such products as: litharge, borax, silica, soda ash, cement, carbon black, ammonium nitrate, limestone, starch, water softening chemicals.

Industry is finding out more and more about the Robinson Method for handling fine, dry, granular or pulverized materials in bulk. After investigating thoroughly many companies are ordering the system.

We'll be glad to hear about your handling problem and if there is any doubt, we'll be glad to make a pilot plant test.

ROBINSON *Air-Activated* Conveyor Systems

***Division of* MORSE BOULGER DESTRUCTOR CO.**

211-A EAST 42nd STREET **NEW YORK 17, N. Y.**

Representatives in Principal Cities

of fine and rare chemicals. Myron Pantzer is sales manager.

Carborundum Co., Niagara Falls, N. Y., has purchased the assembly plant of Philco Corp. in Chicago. After alterations, it will become the Chicago sales office and warehouse of Carborundum.

International Minerals & Chemical Corp., Chicago, has elected James P. Margeson, Jr., executive vice president. Since 1942 he has been vice president in charge of mining and distribution of potash.

Tennessee Products Corp., Nashville, Tenn., has changed its corporate name to Tennessee Products & Chemical Corp.

General Electric Co., Pittsfield, Mass., has completed a new plant for the manufacture of magnesium oxide according to an announcement from John L. McMurphy, manager of the compound division.

Blaw-Knox Co., Pittsburgh, has appointed Pierre H. Couroulcau as consulting engineer specializing in activated carbon installations. Dr. R. E. Benson is directing this new activity of the company.

Joy Mfg. Co., Pittsburgh, has elected E. M. Platts vice president. He has supervision over sales of all products manufactured by the different divisions of the company.

Stein, Hall & Co., New York, will be exclusive distributors in the textile, paper, and adhesives fields for products manufactured by Acryvin Corp. of America.

Ethyl Corp., New York, has appointed Charles E. Colvin manager of the production planning section in its plant at Baton Rouge, La. He succeeds B. E. Perkins, Jr., resigned.

Pittsburgh Plate Glass Co., Pittsburgh, has named George E. Dewey as general personnel director. George D. McClaren is assistant director.

McAlear Mfg. Co., Chicago, announces that William Ludvik has returned to the company as president and general manager having acquired the stock, plant, and equipment of the McAlear division in Chicago from Climax Industries, Inc.

All-State Welding Alloys Co., Inc., White Plains, N. Y., has appointed Richard T. Spear regional sales manager. His territory includes eastern Pennsylvania, south New Jersey, Vir-

BEFORE YOU BUY ANY MOTORIZED HANDTRUCK

Only Transporter GIVES ALL THESE MONEY-SAVING FEATURES!

1. **ONLY motorized hand truck that comes COMPLETE with Standard BATTERY for full day's operation.**
   Benefit: No extra price to pay for battery. Low overall cost of installation including charger. Compare these prices.
2. **THE motorized hand truck whose battery can be charged from a REGULAR ELECTRIC LIGHT SOCKET.**
   Benefit: No installation cost for charging equipment . . . No power line needed. Fully portable . . . charge your Transporter where it works.
3. **THE motorized hand Truck equipped with EITHER electric lift or foot lift. (Optional).**
   Benefit: The right unit for the right application.
4. **Operates at lower cost than ANY OTHER motorized hand truck.**
   Benefit: Pays for itself quicker than any other motorized hand truck.
5. **No complicated control system to manipulate! Easy two-button Thumb-Tip control with foot lift—3 buttons with electric lift. No controls in handle grips.**
   Benefit: Simple one hand, one motion operation, with either hand.
6. **Operator controlled lowering speed.**
   Benefit: Load can be lowered at desired speed; fragile or heavy goods.
7. **Positive Mechanical Brake.**
   Benefit: SAFETY. Most effective brake on any motorized hand truck. Will stop and hold on any incline truck will climb, by raising or lowering handle.
8. **Positive Dead-Man Control.**
   Benefit: SAFETY. When hand is taken off steering handle, it flips back, Transporter stops dead, and current is shut off in two places.
9. **Only motorized hand truck and battery charger that carry the Underwriters Laboratory Seal.**
   Benefit: SAFETY. Neither truck nor charger is a fire hazard.
10. **No grounded circuits.**
    Benefit: SAFETY. Operators need not fear electric shocks.
11. **Light weight, yet engineered and built for full capacity loads.**
    Benefit: More Power per weight ratio than any other motorized hand truck. No oversized battery to carry.
12. **Maximum accessibility to all operating parts.**
    Benefit: All operating parts can be immediately exposed for inspection, adjusting and lubrication. No boxed-in construction.
13. **Steers through more than 180 degrees.**
    Benefit: Easily maneuverable in narrow aisles, close quarters.
14. **World's MOST EFFICIENT—proved by thousands of Transporters now in use in every industry—many more than ALL OTHER motorized hand trucks COMBINED!**
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CORROSION RESISTANCE HIGH STRENGTH HEAT RESISTANCE

Twin tubular condensers of Hastelloy throughout, including tubes, shell, flanges, etc.

The ability of Hastelloy to withstand severe corrosive actions such as those of hydrochloric and sulphuric acids, ferric chloride and wet chlorine over a wide range of temperatures and concentrations is well known. Its resistance to high temperatures and its unusual mechanical strength are recognized factors. However, the fabrication of this extraordinary alloy has always been difficult. Embrittlement, work hardening and unrelieved stress are only a few of the problems encountered.

Pioneering in the fabrication of Hastelloy, Nooter has worked out procedures that overcome these and many other problems involved in turning out isomerization reactors, condensers, agitators, and many other items of Hastelloy equipment for the chemical, refining and processing industries. Wherever your operations require special tanks or vessels, count on Nooter fabrication.

Send for your copy of the corrosion-resistant metals table—just off the press.

NOOTER ST. LOUIS

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ginia, West Virginia, Delaware, Maryland, and the District of Columbia.

Lukens Steel Co., Coatsville, Pa., has appointed W. E. Mullestein manager of field sales.

Koppers Co., Inc., Pittsburgh, has appointed Charles O. Rader manager of commercial sales promotion.

Peter F. Loftus Corp., Pittsburgh, has announced the addition to its staff of Edward T. Moore and Charles B. Cochran.

Alloy Steel Products Co., Linden, N. J., has appointed E. H. Vockrodt Pacific Coast representative.

Corning Glass Works, Corning, N. Y., has appointed Arthur S. Taylor general sales manager of the technical products division. William J. Belknap succeeds him as lighting sales manager.

United States Steel Corp., Chicago, has appointed R. Bruce Hunter manager of the Gary, Indiana plant of American Bridge Co. He succeeds W. A. Thiel who is now in charge of construction and maintenance of the western division plants at Gary and Minneapolis, Minn.

Goodyear Tire & Rubber Co., Akron, has named H. D. Foster manager of mechanical goods division. Sam DuPress has been transferred from the St. Marys, Ohio plant to Akron as assistant manager of the mechanical goods division.

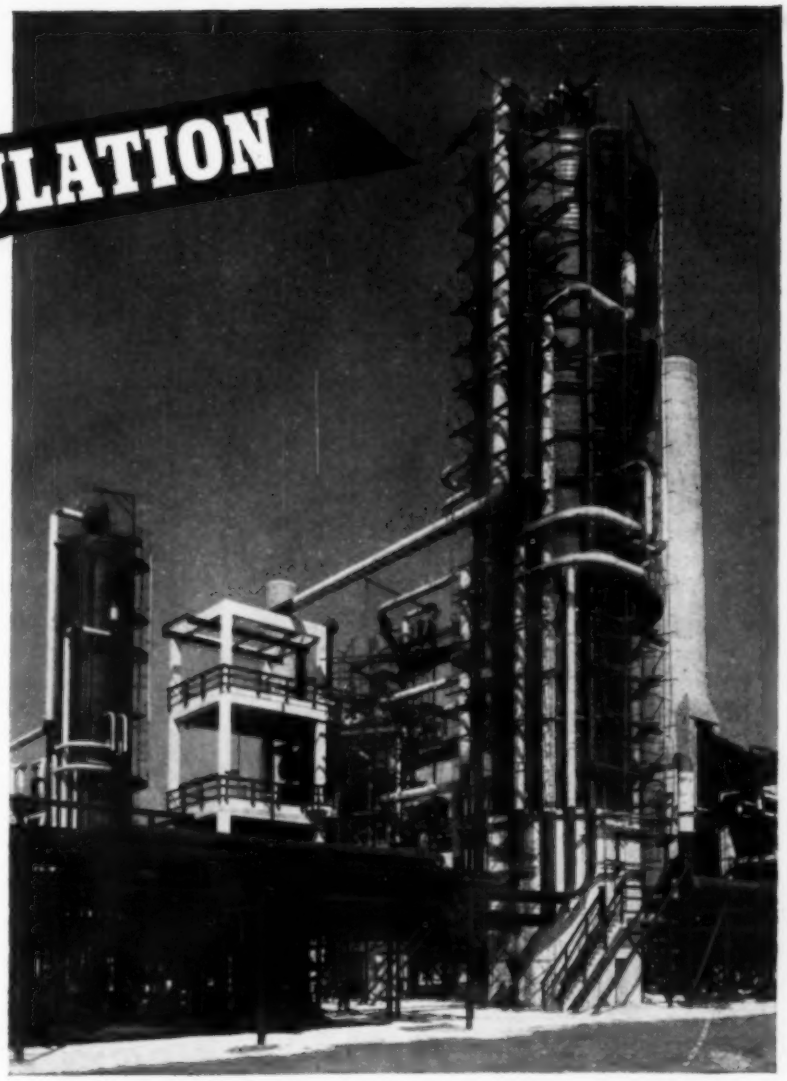
Foster Wheeler Corp., New York, has appointed J. H. Bell sales manager of the new Dallas district which includes parts of Texas, Oklahoma, Mississippi and all of Arkansas.

Laclede-Christy Clay Products Co., St. Louis, has appointed John B. Ives manager of operations. He will be in charge of the manufacturing and mining operations of the St. Louis and Toledo plants and mines.

Sharp & Dohme, Inc., Philadelphia, has named David V. Knott Philadelphia branch manager and Tink L. Johnson acting branch manager of the San Francisco branch.

Aluminum Co. of America, Pittsburgh, has announced that Ralph V. Davies, Robert B. McKee, and Donovan Wilmot, assistant general sales managers have been promoted to vice presidents. Mr. Davies will also become general sales manager to succeed George J. Stanley who retired.

How much is TOWER INSULATION costing you?



More than you think, perhaps! Especially when reinforcing wire and bands corrode and break, and towers have to be reinsulated.

What can you do about it?

Use Monel* poultry wire and Monel bands. They're good insurance against frequent tower reinsulation.

And this is why:

Monel is a solid, corrosion-resistant Nickel Alloy. It's stronger than structural steel . . . has plenty of rigidity and toughness. Monel holds firm against strain, stands up at elevated temperatures.

And you have the word of THE INDUSTRIAL INSULATORS, Houston, Texas, that Monel is easy to work with. It's pliable. Wires bend and twist to snug fits. Bands are quickly, safely crimped.

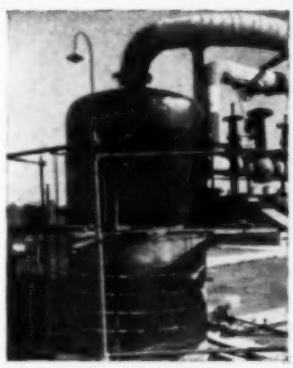
All these qualities add up to rapid, easier installation . . . fewer repair costs.

In terms of service life and maintenance expense—Monel is the economical choice.

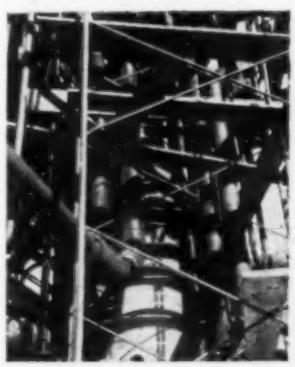
Prove it yourself. Try Monel for your next insulation job. Just drop a line to us for further information about where to get Monel poultry wire and bands.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

BUILT TO STAY ON STREAM LONGER. Tower insulation secured by corrosion-resistant Monel wires and bands requires less replacement, saves frequent erection of costly scaffolding.



FINAL INSULATION COAT in process of application. This coat is applied directly over the Monel reinforcing wire and strip banding holding the pack. (This view taken from top of scaffolding on tower pictured above.)



TOWER MID-SECTION, showing the maze of scaffolding at close range. Monel poultry wire, reinforced by Monel bands, assures a tight, well-insulated job. *Photos courtesy of The Industrial Insulators, Houston, Texas.*

Monel*

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Monel* • "K"* Monel • "S"* Monel • "R"* Monel • "KR"* Monel • Inconel*
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add a "plus"
TO DEEP WELL PUMP PERFORMANCE

Peerless Pumps offer the widest range of water capacities from 15 to 30,000 gallons per minute from all depths

Peerless Pioneered in the development of water from wells of great depth.

Available in water or oil lubricated types. Pre-tested to meet exact conditions of well and application.

Top-Flight Quality Underground From Patented Double Bearing—Double Seal Bowl Construction

Double Bearings (1) one bronze and one Goodrich Cutless Fluted Rubber bearing for each pump bowl add double life to bearings and impeller shaft. Double Seal (2) mounted below impeller neck (3), is a durable, resilient ring — automatically compensating for wear.

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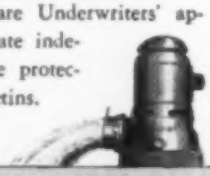

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CONVENTION PAPER ABSTRACTS

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Stream Pollution Problem

The pollution of streams by industrial waste presents a problem of nationwide scope, with the need for sewage and trade wastes treatment most critical in large industrial centers of the Middle West. A watercourse may be used to carry away the spent water supply of a community, as sewage, only if the pollution effect of the wastes can be satisfactorily absorbed by the flow. A heavy pollution load will degrade the stream and interfere with its proper utilization by others, which is a violation of riparian rights under the common law. If the stream is overburdened by wastes, it will be necessary to temper the character of the sewage by treatment. The sewage-borne solids must be extracted and the chemical and biological character of the effluent changed to the degree which is needed for remedy. The sludge, scum, grit and screenings removed by this treatment must be suitably prepared for satisfactory disposal as well.

It was determined by a survey of the U. S. Public Health Service that in 1942 the country needed: for sewers 1.2 billions of dollars; for municipal sewage treatment 0.7 billions; for industrial waste treatment 0.15 billions at municipal plants and 0.16 billions at independent plants. The needs for sewage and trade waste treatment is most critical in the highly concentrated population belt of urban communities extending from the New England and North Atlantic states west through the Great Lakes, Ohio River, and upper Mississippi River drainage basins. The estimated needs in industrial waste treatment plants in millions of dollars, divided somewhat equally between municipal and independent plants, were detailed for ten states as follows:

Illinois 22.1 millions of dollars; Indiana, 9.0; Iowa, 7.2; Kentucky, 5.1; Michigan, 6.1; Minnesota, 5.4; Ohio, 16.2; Pennsylvania, 35.0; West Virginia, 4.9; Wisconsin, 3.1.

The treatment of domestic sewage, for which there are some 6,000 treatment plants, involves certain standard methods. Much industrial waste can be handled in conjunction with domestic sewage. However, the treatment of industrial waste often involves unusual and diverse problems which must be met individually.

There is, however, a general trend toward dividing the costs of industrial waste disposal between the municipality and the industry. It is never the policy of a state or municipality to throttle industry by undue restrictions.

In general, municipalities and sanitary districts in certain localities have felt they have gone about as far as they can in assuming the burden of sewering industry and treating industrial wastes in conjunction with domestic wastes, and there is a definite trend to charge incremental costs for sanitation to industries direct, and to upgrade the sanitation of communities and streams. The methods for sewage sludge handling have always been aimed for profitable results, in the sense that costs are kept to a minimum, but there has been no "profit" in the accepted sense of the word. Even when low grade or high grade fertilizer is produced, there is still a cost to sludge handling which is reduced but not offset by income; and the means of disposal are selected to secure minimum net overall expense for treatment.

George E. Barnes, Case School of Applied Sciences, before Process Industries session of semi-annual meeting, the American Society of Mechanical Engineers, Chicago, Ill., June 17, 1947.

Silicone Oil Improves Rubber

RUBBER that defies attack by heat, weather, and chemicals has been made possible by a new kind of softening oil made from sand.

Rubber prepared with the new softener also has increased resistance to abrasion, can be extruded more rapidly and smoothly, and repels water. The improved performance is attributed to the inertness of the oil, a typical member of the recently developed class of silicone materials.

GR-S synthetic rubber, a type widely used for automobile tire treads, when loaded with silicone oil showed remarkable improvement in abrasion resistance. No processing difficulties were encountered, and it was found that the oil can be either mixed with the carbon black used to strengthen the rubber, or else can be added directly to the compound during processing.

Resistance to straining was somewhat reduced, but this is to be ex-

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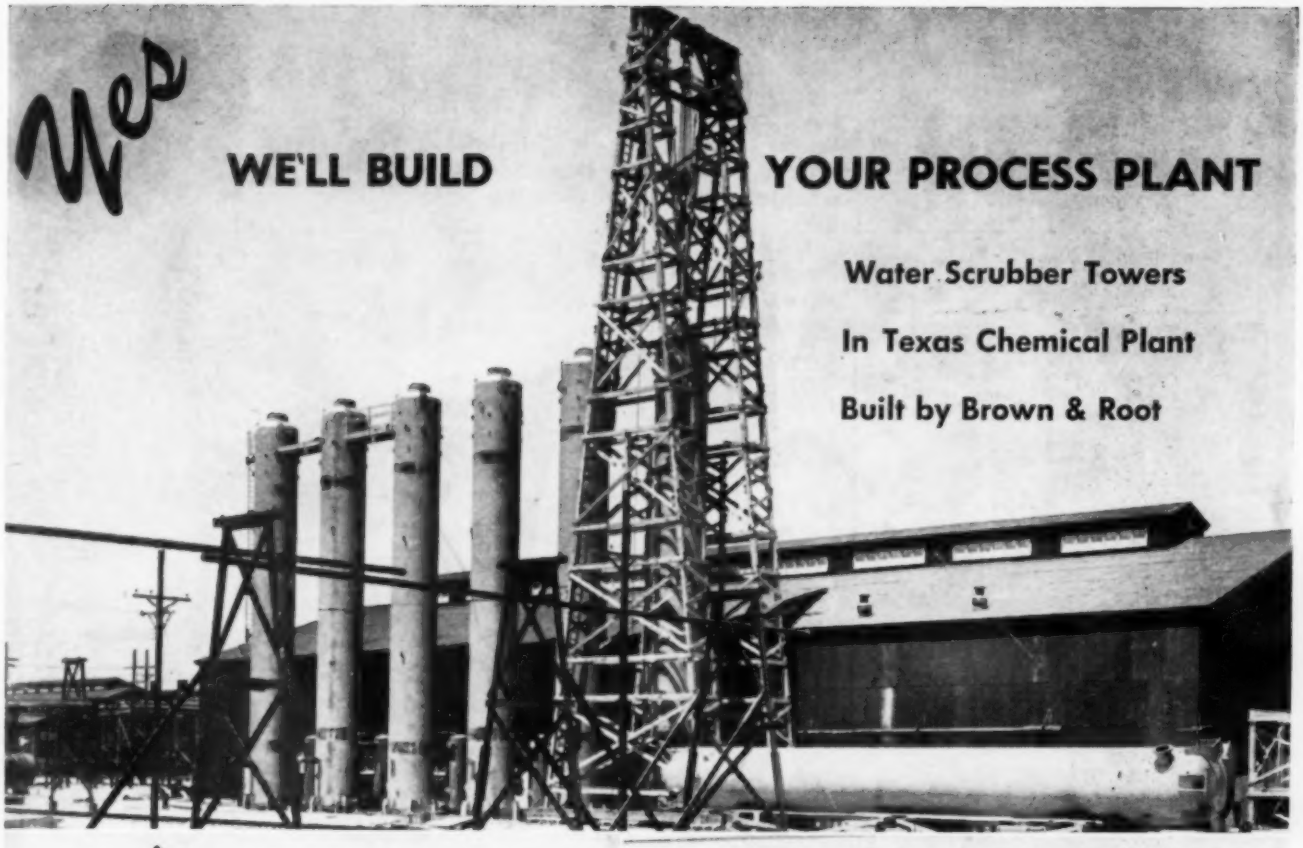

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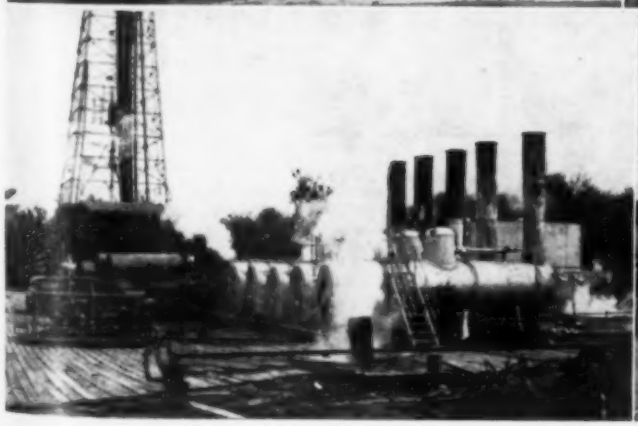

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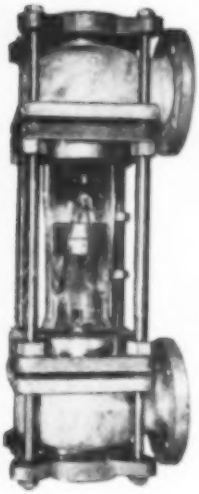

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H_2SiF_6
$Al_2(SO_4)_3$
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And similar "tough-to-meter" fluids are being readily handled

The F & P Hard Lead FLOWRATOR (variable-area type flow rate meter) is unusually well adapted for severe services.

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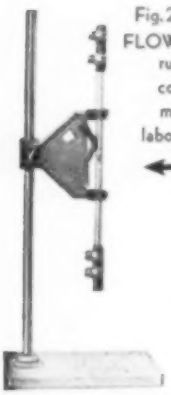

Fig. 27—All-Glass FLOWRATOR with rubber hose connections, mounted in laboratory stand

Fig. 735-BH—Master-Enclosed FLOWRATOR with leveling screw, spirit level and hose nipple connections

The F & P FLOWRATOR, variable area type flow meter, permits an instantaneous reading of the true flow rate. Each instrument is accurately calibrated at our factory for your exact requirements.

Liquid flows down to 0.15 cc per min. and gas flows down to 3.0 cc per min. can be measured with ease. All-glass meters are now sold at EVEN LOWER prices than prevailed during the war.

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FLOWRATOR
TRADEMARK
FISCHER & PORTER CO.
DEPT. 7T-98 HATBORO, PENN A.

pected if the oil is considered as a non-reinforcing, liquid filler.

Abrasion resistance was more strikingly increased in rubbers that had been reinforced with lower grades of carbon black. It was found that silicone oil had less effect on rubber compounded with channel black and the finer furnace blacks.

Cost considerations at present preclude the use of silicone oil in rubber compounding, but volume production may change the price picture considerably. Lower loadings may be satisfactory in special applications, and certain combinations of physical properties inherent in silicone oil-bearing stocks may prove attractive.

Harry J. Collyer and Eli M. Dannenberg, Godfrey L. Cabot, Inc., before Division of Rubber Chemistry, the American Chemical Society, Cleveland, Ohio, May 28, 1947.

National Defense

In 1937 the Secretary of War established the Chemical Advisory Committee of the Army and Navy Munitions Board and on that Committee and its subcommittees were represented all of the leading manufacturers in the chemical industry. Many industrialists were hesitant to accept the invitation to give war-time service on these committees inasmuch as the Department of Justice indicated the possibility of prosecution under the Anti-Trust Laws. It is suggested that steps be taken toward consideration of new Legislation which will make it possible to cooperate within industry in preparation for national defense without the danger which would result from publication of confidential information. Legislation should also insure those who are giving such voluntary service against prosecution under the technical provisions of the Anti-Trust Acts, for any action taken in cooperation with the government on the problems of national defense.

The chemical industry supplies the essentially needed chemicals to support the seventy leading industries of America, and unless American research and development keep abreast of the progress of the world, the United States will find itself at a great disadvantage, if not helpless, against the attack of any aggressor nation. The next war will be won by that nation which has kept abreast of progress. Such a program entails endless research and development. If the tremendous development in the chemical industry is to be sustained, the necessarily large and expensive research programs cannot be conducted by individuals or, to any great extent, by small businesses, nor effectively by government. They must be carried out chiefly by those

THE REQUISITES . . .

A complete dust and fume control system for a process plant should embody these facilities:

Proper hoods, nozzles and enclosures, in a minimum of space, to assure all dust and fumes entering the ductwork.

Correct design, layout and capacity of ductwork to afford minimum resistance, elimination of settling out of heavier particles, reduction of wear and recovering of usable materials.

Dust collecting equipment that is mechanically efficient, permits interior inspection, of sturdy construction, and with the fan on the clean air side of the collector.

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Means for removal of collected contamination without the necessity for shutting off the system.

Ventilation inlets for replacement air, properly located to assure all working areas being constantly swept by fresh air.

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● The Schneible line includes all equipment required for complete dust and fume control and ventilation in process plants. Schneible installations embody correct engineering, the use of materials for maximum service under the conditions encountered, and the greatest ultimate economy. Submit your dust and fume problems.

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DUST AND FUME CONTROL HEADQUARTERS FOR THE PROCESS INDUSTRIES

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RUBBER FRAME GOGGLES

for prime protection against acids, sprays, dusts

This highly serviceable goggle combines maximum protection, comfort and wide-angle vision. Perforations at top and sides let in air, reduce fogging possibilities. A filter element keeps acid or dust from eye area.

The AO 700 goggle is particularly recommended for the following operations:

- Work on acid lines.
- Repairing and maintaining storage batteries.
- Work on metal plating baths.
- Cleaning and degreasing where caustics or acid solutions are used.
- Foundry shakeout work.
- Railroad car cleaning.
- Cleaning coal handling equipment.
- Work in holds of ships.
- Locomotive driving and firing.

Write for descriptive bulletin or ask your nearest AO Safety Representative for complete details.

QUICK FACTS

- Airtight fit provides maximum protection against chemical and dust hazards.
- Cushioned bridge and other face-contacting edges for comfort.
- Single shatter-resistant acetate lens.
- Large "seeing" area.
- Ample ventilation.
- Quickly replaceable lens.
- All-rubber, non-irritating, acid-resistant frame conforms to face contours.
- May be worn directly over eyes or over prescription glasses.

All-rubber frame scientifically curved to conform to facial contours. Broad face-contacting surfaces cushioned for additional comfort.

Filter element, made from fabric backed with acetate, is set away from edge of frame. With outside perforations, this provides indirect ventilation.

Lens replacement is simple. Just unfasten snap button, force out lens, and thread headband through slot at end of lens.

American Optical
COMPANY
SOUTHBRIDGE, MASSACHUSETTS
Safety Division

companies with large research facilities and whose financial budgets permit spending the large sums required.

In looking to the future, we must never disregard the potentials of those nations which might some day again challenge the peace of the world. We must not overlook the fact that Russia possesses some of the new and most modern German chemical plants, some of which are being operated where built and others which have been removed to Russia. Technicians have been persuaded to leave their German homes and follow these plants to operate them, when they have been reassembled. There is little doubt that they will be successfully operated and find markets for their output pending the day when they might be needed for War production. One has only to contrast the average wage paid in the chemical industry in America—which is in excess of $1.50 per hour—with the cost of labor in Germany and particularly in Russia. Certainly, we may reasonably expect that world markets, which are supplied by us today, will present some difficult competitive conditions, price-wise, in the future.

There is danger that many war-time developments of chemistry may be abandoned, either because they are not applicable to peace-time uses, or because of the high cost of production in a normal peace-time market. Many of these should be retained and further improved against the day when they may again be needed.

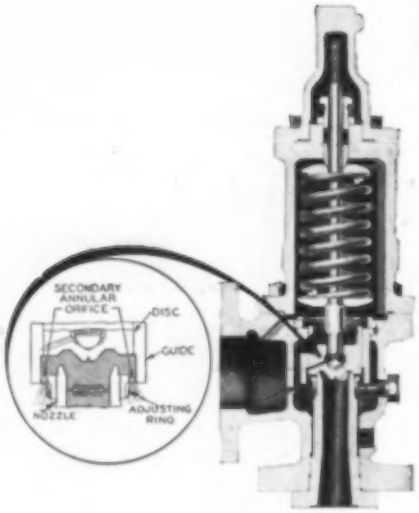
The Chemical Warfare Service Association and the Army and Navy Munitions Board are urged to coordinate research and development, while industry leaves nothing undone to keep its strength and facilities marshalled as an agency to maintain peace in the world, and carry out the policies of the United Nations. The assurance of peace would be enhanced by a nation strong in resources, fully prepared and financially sound.

Harry L. Derby, American Cyanamid and Chemical Corp., before the Chemical Warfare Service Association, Edgewood Arsenal, Md., May 23, 1947.

Atomic Power Plants

In general, the problem of using atomic energy for practical power production is that the construction of atomic reactors requires materials whose properties are largely unknown under the operating conditions. New materials will have to be developed so that the greatest efficiency of operation will be achieved. In all of this work the engineer will have to take account of the nuclear properties of materials as well as properties already known.

Among the problems is that of the heavy shield that must be provided



Capacity Safe!

FIELD adjustments cannot alter the rated capacity of a CONSOLIDATED Safety Relief Valve.

The single ring blow-down adjustment controls blow-down only. Blow-down adjustment is not dependent upon multiple rings and cannot affect lift and capacity by disturbing the area of the secondary annular orifice. These fixed secondary orifice dimensions cannot be accidentally altered during maintenance. CONSOLIDATED is a truly "capacity safe" safety valve.

The outside bevel seat and floating guide construction eliminates leakage under discharge piping stresses, and assures maximum tightness under all conditions of operation.

Simplicity of design with 25% fewer parts and maximum interchangeability, reduces maintenance and minimizes standardization problems.

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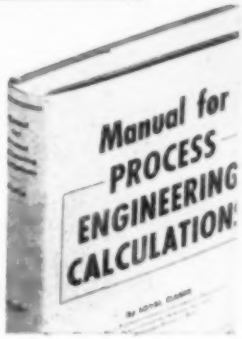
Over 300 tables, charts, diagrams and equations included . . .



This indispensable manual supplies engineers and chemists with a vast supply of concise, practical data to aid in engineering the development of chemical processes—from the research report stage to the final design stage. The material in this helpful book covers conversion factors, physical and mechanical properties, equipment performance factors, and briefs of the theory involved in unit operations common to many processes. Featured are hundreds of tables, charts and equations which are of the most aid in process engineering. Each is self-explanatory, and includes a complete listing of symbols, their significance, and units.

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Weight 9" straight	10.1 lbs.

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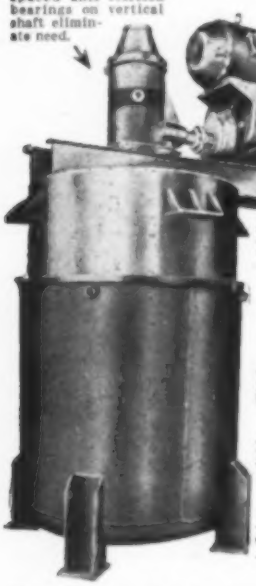
FOR PRODUCTS THAT CHANGE CONSISTENCY DURING PROCESSING

★ No step bearing required in tank... wide spaced anti-friction bearings on vertical shaft eliminate need.



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I★P★E also designs and builds complete equipment—for resin esterification, continuous neutralization, continuous organic processing, paint and varnish manufacture, etc.—and DELIVERS ON TIME.

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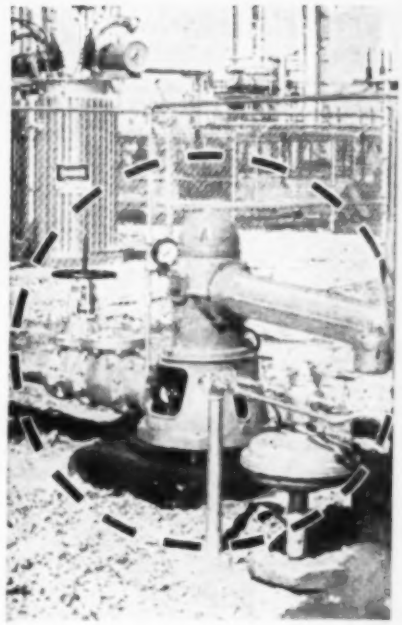
against the death dealing emanations from the atomic power plant. It has been shown that if one pound of uranium, an amount about the size of a golf ball, undergoes fission, energy in an amount roughly equivalent to 200,000 gallons of gasoline will be released, or enough for the average motorist to run his car 200 years. Unfortunately it has been estimated that in order for it to be safe for a human being to be near an atomic reactor, at least 50 tons of shielding material are required. While this rules out small mobile installations, such a weight of shielding would not be particularly deterimental in stationary units or in large propulsion units, such as might be used on ships.

A second problem has to do with the removal of waste products from any practical atomic furnace. In the Hanford plant, the problem was solved by removing the canned uranium slugs at regular intervals, dissolving the contents by a laborious chemical process, and separating out the uranium and plutonium for further work. This might be a fairly straight forward operation, were it not for the fact that the fission products are so strongly radioactive that all chemical manipulation has to be done in batch processes by remote control behind thick concrete shields. The replacement of the batch handling by continuous methods would do much to lower the cost of atomic energy. This involves the choice of the "moderator," that is the medium by which the fast neutrons produced in the fission process are slowed down in order to set up the chain reaction. The substance must slow down the neutrons in as few collisions as possible, since thus the chance of losing neutrons will be reduced. Besides this slowing down ability, however, it must not lose too many neutrons by a process of absorption. Possible choices are hydrogen, helium, lithium, beryllium, boron and carbon. Hydrogen, lithium and boron absorb neutrons too readily. Helium, otherwise excellent, requires the use of very high pressures to obtain a high density of atoms since it is a gas. Beryllium and carbon are good. The latter, because of its availability in the form of graphite, actually is used in the chain reacting piles now operating.

Besides uranium-235 and other fissionable elements, some elements not now practicable may eventually be used in atomic reactors. Cadmium, for instance, has long been known as one of the best absorbers of slow neutrons. If separated isotopes of any element become available at reasonable cost, it will mean having additional building materials for atomic reactors. Then we may utilize elements not now acceptable because one or



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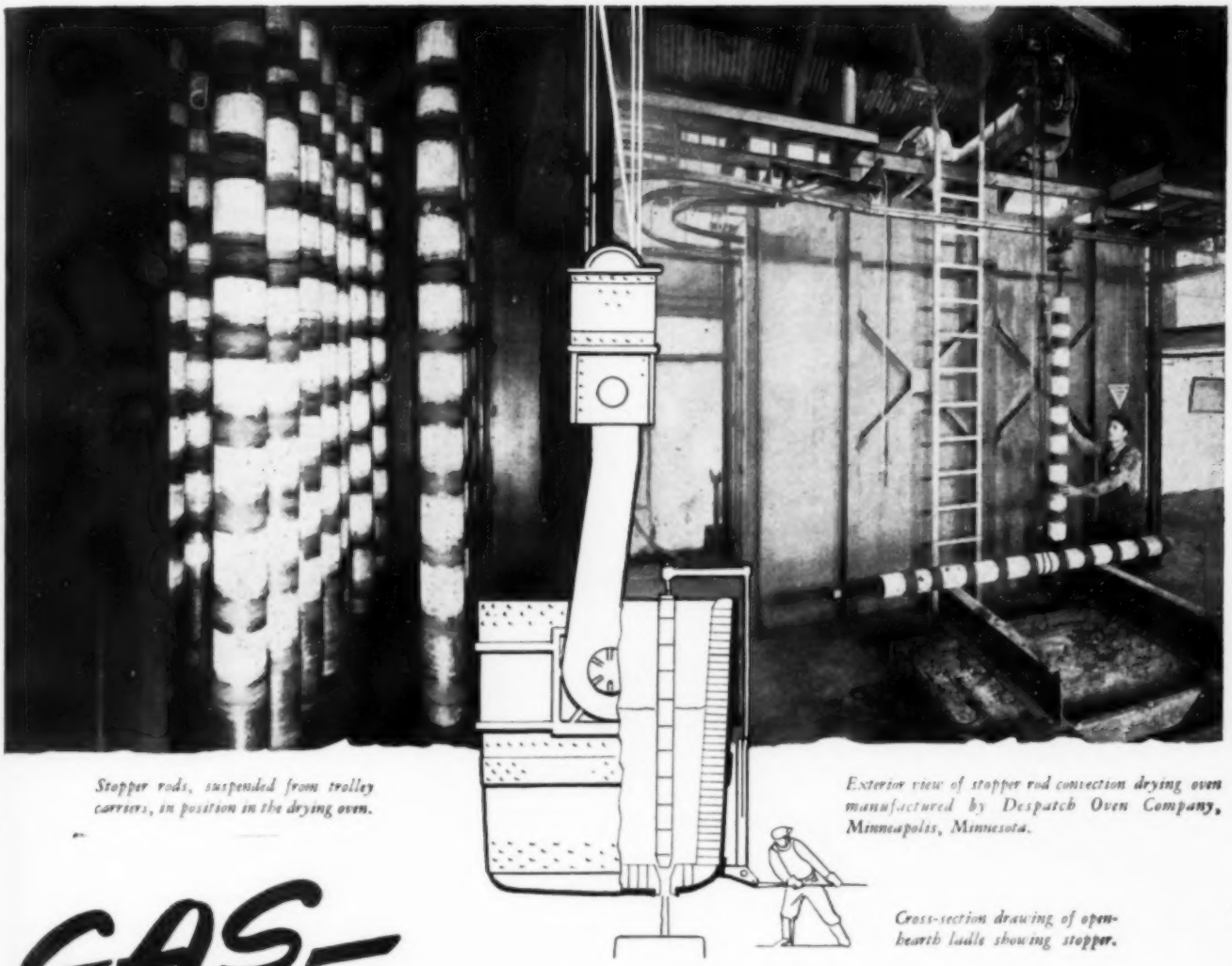

Stopper rods, suspended from trolley carriers, in position in the drying oven.

Exterior view of stopper rod convection drying oven manufactured by Despatch Oven Company, Minneapolis, Minnesota.

Cross-section drawing of open-hearth ladle showing stopper.

GAS— production-line fuel for CERAMIC FIRING...

Controllability of the fuel, and the flexibility of modern Gas Equipment, have established GAS as the logical medium for drying, annealing, batch melting, baking and other ceramic heating processes.

These production-line characteristics of GAS proved useful in stopper-rod manufacturing at Scullin Steel Company, St. Louis, Missouri. Since each open-hearth ladle must be equipped with a new rod for every heat, the process of drying the fire-clay bonded graphite sleeve and head on the rod must be timed with steel production schedules.

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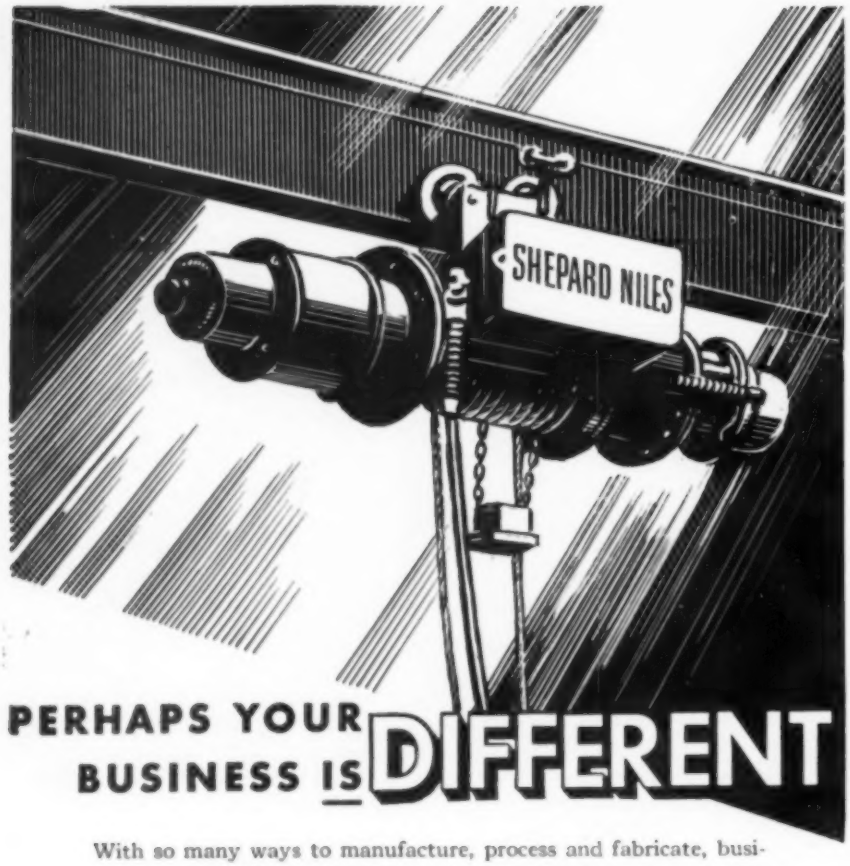

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With so many ways to manufacture, process and fabricate, businesses may be different insofar as shop practice is concerned. But regardless of whatever competitive advantages you enjoy, your material handling problem is common to all industry. Heavy loads must be picked up, moved and deposited with speed, safety and economy.

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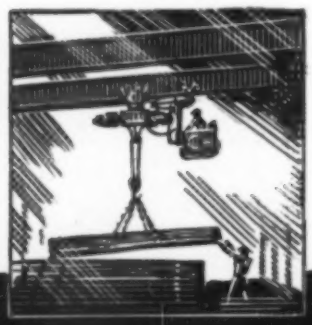

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more of their isotopes may have objectional properties. At the present time the separation of isotopes is so difficult and expensive that only in the case of uranium does it pay to carry out the separation.

The problem of producing atomic energy is largely one of making efficient use of neutrons. This and the concept of atomic fission are really the only basically new factors with which the engineer must contend. Otherwise the problem of producing atomic energy involves merely modifications of problems which engineers have already solved or will solve in connection with other work. Incidentally, one of the most immediate needs is that of a set of nuclear codes and standards to insure an orderly and safe development of the field.

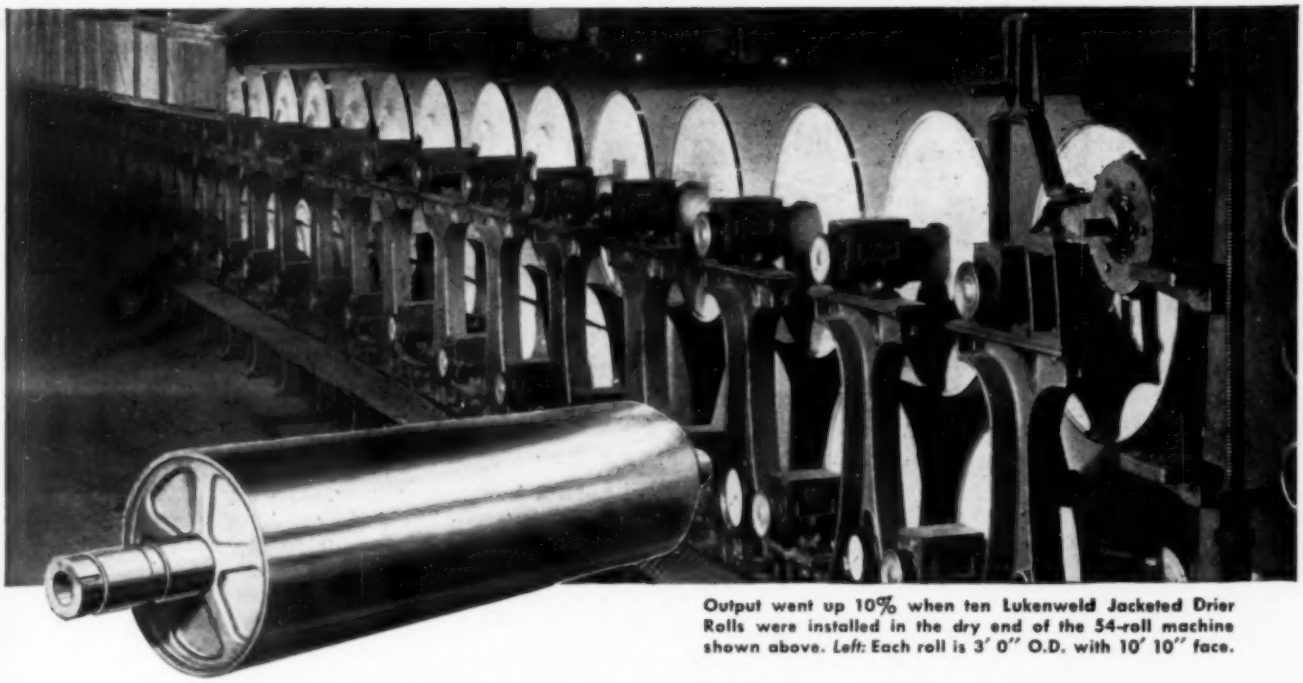
Alfred O. C. Nier, University of Minnesota, before the semi-annual meeting, the American Society of Mechanical Engineers, Chicago, Ill., June 17, 1947.

Cottonseed Extraction With Isopropanol

THIS is a report of studies made at A. & M. College of Texas on the use of isopropanol and mixtures of isopropanol and hexane in the solvent extraction of gossypol and other substances, as well as oil, from cottonseed meats. Liquid-liquid extraction methods have been found applicable for separation of oil and fatty acid fractions from the miscella. Swine and rat feeding tests on the raw extracted meal have shown it to have nutritive value markedly superior to commercial hydraulic meal.

Pilot plant extractions of the meats were made in a small continuous extractor of the screw type charging 6 lb. of cottonseed flakes per hr. The flakes were moved countercurrent to the preheated solvent, then out of the solvent and through a steam-jacketed drying section. Extractions were made with commercial 91 percent isopropanol, 99 percent isopropanol and mixtures of isopropanol with commercial normal hexane. A larger and improved pilot plant, with a capacity of 100 lb. of meats per hr., will be built this summer.

Analyses of the extractions show that 91 percent isopropanol is an efficient solvent for extracting active gossypol along with oil. Extractions with 99 percent isopropanol gave a very light meal, but did not remove as much of the free gossypol as did those with 91 percent isopropanol. Also, the 99 percent concentration dehydrated the meats, so that disintegration occurred with some resulting fines. The optimum concentration seems to be between 91 and 99 percent. Hexane-



Output went up 10% when ten Lukenweld Jacketed Drier Rolls were installed in the dry end of the 54-roll machine shown above. *Left:* Each roll is 3′ 0″ O.D. with 10′ 10″ face.

DRYING EFFICIENCY UP 50%

with Lukenweld Jacketed Drier Rolls

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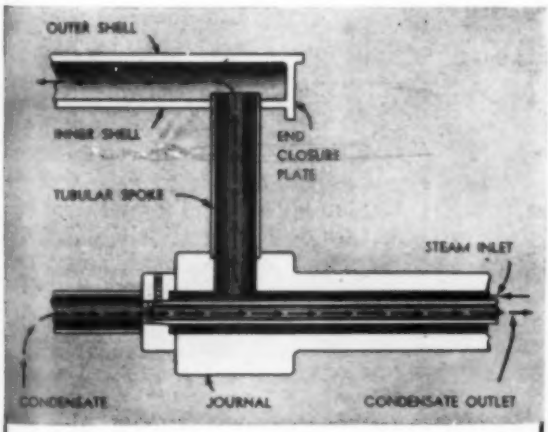

Section of a typical Lukenweld Jacketed Drier Roll, showing how steam is circulated against the roll face. Working surface may be carbon or low-alloy steel, solid stainless, Monel or other nonferrous metals or clad steels.

You can get increased production from your present equipment by installing Lukenweld *Jacketed* Drier Rolls. Here is a case in point:

The last 10 of 54 cast rolls in a large machine were replaced with Lukenweld Jacketed Drier Rolls. Steam pressure was increased from 50 to 140 psi. Drying efficiency of these 10 rolls went up 50 per cent. Machine output was increased 10 per cent!

Another test was made without increasing steam pressure. Residual moisture in the felt was reduced 28 per cent by the Lukenweld Jacketed Drier Rolls. Production was increased approximately 5 per cent.

Lukenweld welded steel design helps you get faster, more efficient drying in two ways. You can use higher steam pressures safely—up to 350 psi., or more. And, the double-shell steel plate construction gives greatly improved heat transfer properties. Numerous installations show drying rate stepped up 15 to 18 per cent *with no increase in steam pressure.*

The complete story about Lukenweld Jacketed Drier Rolls is worth money to you. Write for Bulletin 358. Lukenweld, Inc., Division of Lukens Steel Company, 400 Lukens Building, Coatesville, Pa.

Sizes from 2 feet to 18 feet O. D. and over

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isopropanol mixtures proved not as efficient for reducing gossypol as the isopropanol solvents.

On the basis of oil solubility, 91 percent isopropanol is approximately the minimum feasible concentration to use. On the other hand, it may be desirable to use higher alcohol concentrations at somewhat lower temperatures to prevent the extraction of considerable quantities of sugars, inasmuch as these sugars have no present market value. This objective may also be reached by using isopropanol-hexane mixtures.

In the experimental work it was found necessary to increase the moisture content of the meats to 10-12 percent before flaking, since at low moisture content the solvent would not percolate through the meats. High moisture proved beneficial in three other ways: Better flakes were produced by the rolls; occurrence of fines in the miscella and in the dryer was almost eliminated; and extraction of gossypol was improved. When 91 percent isopropanol was used, it was found desirable to preheat the solvent to 170 deg. F. or higher and to maintain at least 160 deg. F. in the extraction section. Lower temperatures caused the separation of a heavy oil which was carried back along with the meats. The combination of high moisture in the meats with 91 percent isopropanol caused fine meat particles to coagulate during extraction and to settle readily, so that the miscella emerged clear. No dust was obtained in the meal dryer.

A typical analysis of an extraction run using 91 percent isopropanol when cottonseed flakes and solvent were fed at rates of 6 lb. and 31.1 lb. per hr., respectively, showed that the extracted meal contained 0.3 percent oil (N.C. P.A. method) and 0.0108 percent gossypol.

W. D. Harris, A. & M. College of Texas, before South Texas Section, American Institute of Chemical Engineers, Houston, May 27, 1947.

Distillery Problems

As it looks to the distiller, the chief problem is the industry's stability and continued progress as a vital and important part of America's economic structure.

Social aspects also are important. Such factors as public sentiment toward the industry, undesirable outlets, price wars, and other prejudicial influences of a social nature—cannot be overlooked. Also the competitive buyer's market has arrived and will bring added problems as it becomes even more competitive. And, above all, if the public interest is to be

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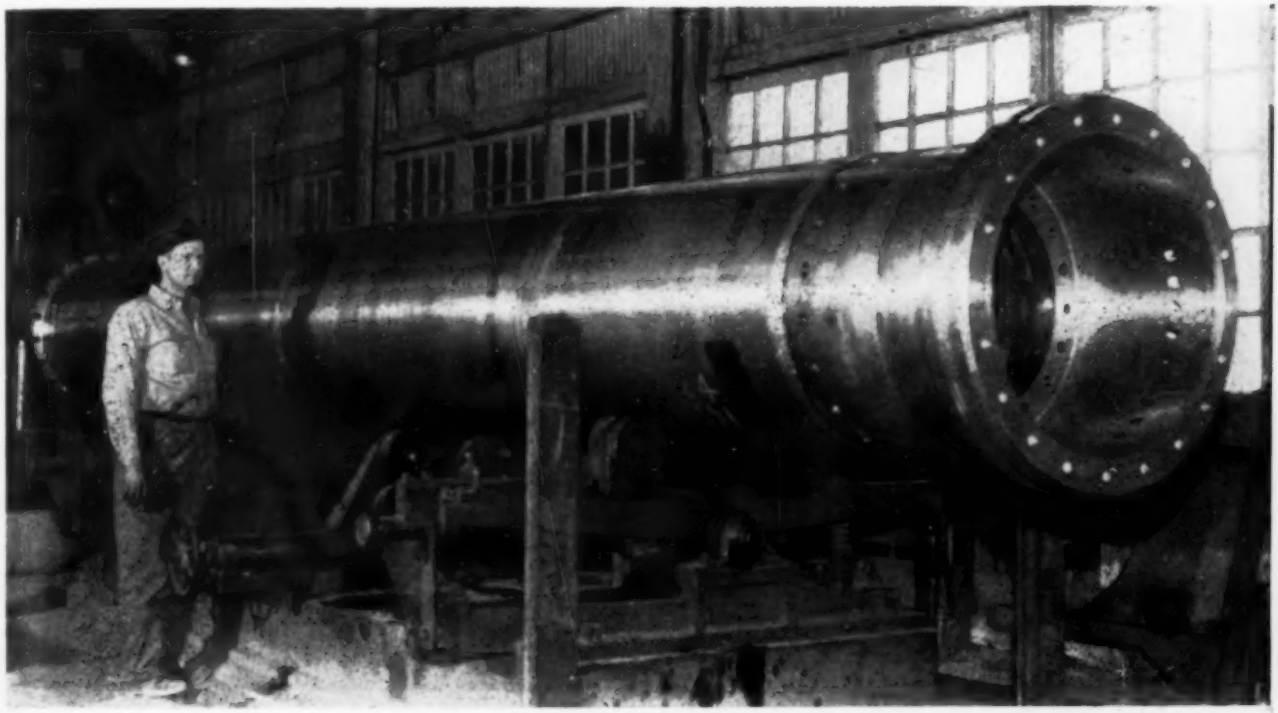
Tubes & Parts



One of several 25%-20% Chrome-Nickel Stainless Steel Retorts furnished to a large chemical manufacturer. Fabricated by electric welding of centrifugally cast tube sections machined 34" O.D. by 32" I.D. by 12'-0" long, and end flange sections cast in stationary sand molds, to make a completed unit 27'-6" long. Completely machined all over. Hydrostatically tested at 300 p.s.i. and air tested at 100 p.s.i. Weight per unit 13,600 lbs.

Extensive facilities permit quantity production of centrifugally cast stainless and carbon steel tubes in diameters from 3.50" to 50" O.D. Wall thickness can be varied to suit specific applications. In addition, alloy cast irons, including the Ni-Resist grades, can be furnished in tubes of the same range of diameters and in pipe fittings. Static sand castings can be furnished from one pound to several thousand pounds.

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served, the laws and regulations laid down for the proper conduct of the industry, must be enforced rigidly.

One of the greatest menaces to the industry today is the occasional licensee whose character and conduct are such that he gives cause for a movement to impose local prohibition. The industry, having no control over such a dealer, can only make the best of it if the licensing authorities permit undesirables to become licensees.

Over the entire country last year, according to the carefully kept records of the Distilled Spirits Institute's local option bureau, there was a net gain in dry population of 285,309 as compared with a dry gain of 325,815 in 1945. The percentage of population of the country living in dry territory at the end of 1946 was 19.1 as compared with 18.9 at the end of 1945. These percentage figures include the population of the three legally dry states.

As was the case in 1945, the largest percentage loss in wet population in 1946 occurred in a few Southern states. In Arkansas there was a net dry gain of 15,488; in Kentucky a dry gain of 157,469 and in Virginia a dry gain of 104,364, making a total dry gain in these states of 415,281. For the country as a whole, however, the net loss to the wet cause was only 285,309. This was brought about principally by considerable wet gains in Alabama, Texas and Minnesota.

The few remaining government restrictions are expected to be removed soon. There is still the Federal excise tax of $9 per proof gallon, which appears to be with us indefinitely. There have been an unprecedented number of revenue raising measures introduced in state legislatures this year, and the happy hunting ground seems to be the alcoholic beverage industry.

Records of the legislative reporting service of the Distilled Spirits Institute show that 27 bills to increase tax on spirituous liquors have been introduced this year in various state legislatures, and thus far six of them have been enacted into law. The states affected are Arkansas, Nevada, Minnesota, New Jersey, Tennessee, and New York, where a temporary $1.50 per gallon tax was made permanent. Florida, however, turned the tables, and cut its tax from $1.92 to $1.20 per gallon. Municipalities also have sought to dip into the pool of alcoholic beverage taxation.

Apparently, too many state legislatures in their zeal to turn up more revenue, overlooked the fact that Federal excise taxes have jumped more than 400 per cent since 1938. Nor have the state legislatures taken into consideration the fact that the state taxes when added to the $9 Federal

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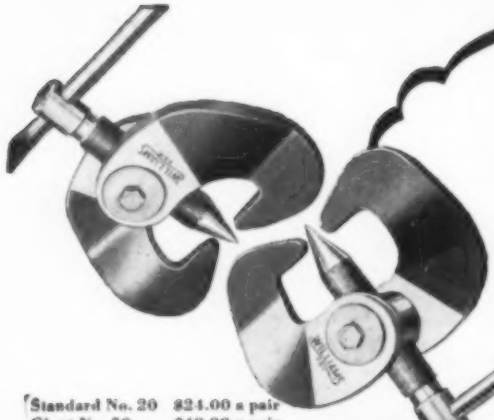

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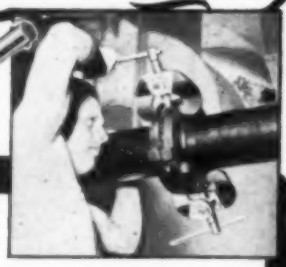

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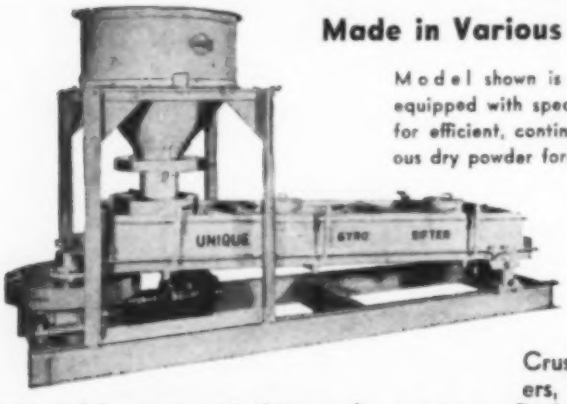

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tax, have raised the average tax per gallon to $10.22. This means that at least $2.04 of the price paid for a 4/5 quart bottle of 100 proof whiskey, is tax money.

Like the Federal tax returns, revenues returned to state and local governments from distilled spirits, have mounted steadily since Repeal, and reached a record breaking net total last year, of $464,000,000—after deducting all costs of administration, collecting, licensing and enforcement.

What about the whiskey supply? It is predicted that by the end of 1948 mature stocks of four year old whiskey will be extremely scarce and that total inventories as of the end of 1948 will be in excess of 500,000,000 original proof gallons. This inventory does not represent any threat to the stability of the industry, as some of this whiskey will have to be carried forward to be used as five, six and seven year old whiskey, which means that the same crop of whiskey will have to be large enough to be bottled at several different ages over a period of several years. If production is held to approximately a replacement level, once this inventory of 500,000,000 original proof gallons is reached, conditions in the industry should remain very stable.

Joseph A. Engelhard, Distilled Spirits Institute, before National Conference of State Liquor Administrators, May 19, 1947.

Chemistry in Oil Refining

THE evolution of the oil refining industry during the past twenty-five years has been along two fundamental lines: first, a perfection of the physical processes for separating different quality fractions, and second, an ever-increasing application of chemistry and chemical engineering.

With respect to the development of processes for physically separating different quality fractions, brief mention should be made of: (1) The advancement in distillation equipment; (2) the use of such solvents as sulphur dioxide, phenol and furfural to remove from paraffinic fractions of petroleum both naphthanic and aromatic compounds; and (3) the development and rapid increase in utilization of solvent dewaxing and deasphalting methods which, in conjunction with solvent extraction, have completely revolutionized the processes for manufacturing lubricating oils.

To an ever-increasing extent oil refineries are supplying more and more raw materials for use in manufacturing chemicals. There are six major refining processes in which chemical reactions occur and which have been or

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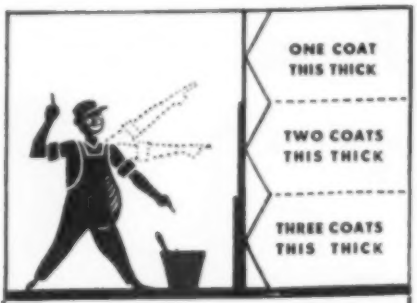

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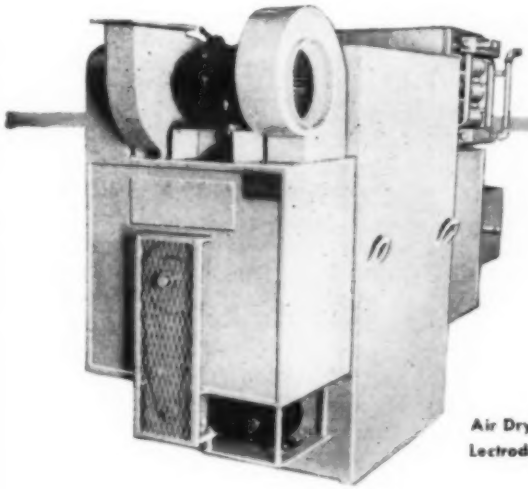
are being applied on a large scale: (1) Catalytic cracking, which resulted from the demand for higher octane quality motor gasoline; (2) alkylation, in which process isobutane is reacted with propylene, butylenes, or amylenes to produce high octane fractions suitable for use in aviation gasoline motors; (3) isomerization, which was utilized to obtain sufficient isobutane to operate the alkylation units; (4) polymerization, first used to produce iso-octane and subsequently used to produce so-called "selective polymer", which, upon hydrogenation, yields a mixture of octane isomers suitable for use as a blending agent in 100 octane aviation gasoline manufacture; (5) hydrogenation, a process used to convert polymers into saturated compounds, and to increase the paraffinicity of lubricating oil, diesel oil and kerosene boiling range fractions; (6) dehydrogenation, which is currently being applied in oil refining primarily to produce aromatics.

With the marked expansion in chemicals manufacture, the chemical industry has turned to petroleum in search of an abundant supply of raw materials. Consideration of the volumes of chemical raw materials potentially available from petroleum may leave the impression that a substantial portion of petroleum is being diverted to this use. Such an impression would not be founded on fact. For example, the rubber needs of the entire world could be produced from 0.5 of 1% of the world's crude oil production and another 0.9 of 1% would take care of the world's alcohol requirements, both for industrial and beverage use. Despite the wide range of chemicals and synthetic products being produced from petroleum today, only a fraction of 1% of the total production is being so utilized.

The development of many of the improved refining techniques has made available large volumes of potential raw materials for the manufacture of chemicals, including olefins, diolefins, and aromatics. An idea of the magnitude of the utilization of these materials in the solvent field is indicated by the fact that about 5 percent of the country's methnaol production, 50 percent of its ethyl alcohol production, 100 percent of isopropyl alcohol, 75 percent of acetone, 35 percent of normal butyl alcohol, and 90 percent of U.S. amyl alcohol production is synthesized from petroleum or natural gas. Approximately 100,000 tons annually of plastics are derived wholly or in part from ethylene. Some 30 percent of the toluene produced in the United States today is being made from petroleum; and, during the latter war years, some 450,000 tons per year

Dry those Feeds

TO HIT WHERE YOU'RE AIMING



Air Drying Lectrodryer

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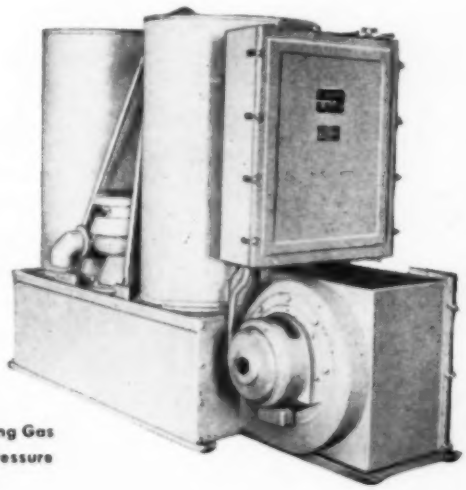
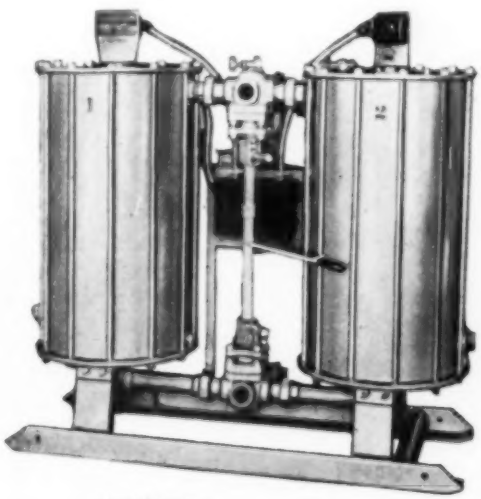


For Drying Gas Under Pressure

You're feeding a gas which enters into a reaction, may affect the catalyst, or is inert. Variation of its moisture content may cause wide variations in product quality or make you miss your aim completely.



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of butadiene were produced for the manufacture of synthetic rubber. There now appears to be a very real possibility of developing all hydrocarbon resins of interesting properties.

The production of chemicals from petroleum sources may be significantly affected in the future by the manufacture of liquid fuels from natural gas by the process generally referred to as the hydrocarbon synthesis process. Recent published information indicates that the manufacture of gasoline from natural gas can probably compete economically with its manufacture from petroleum.

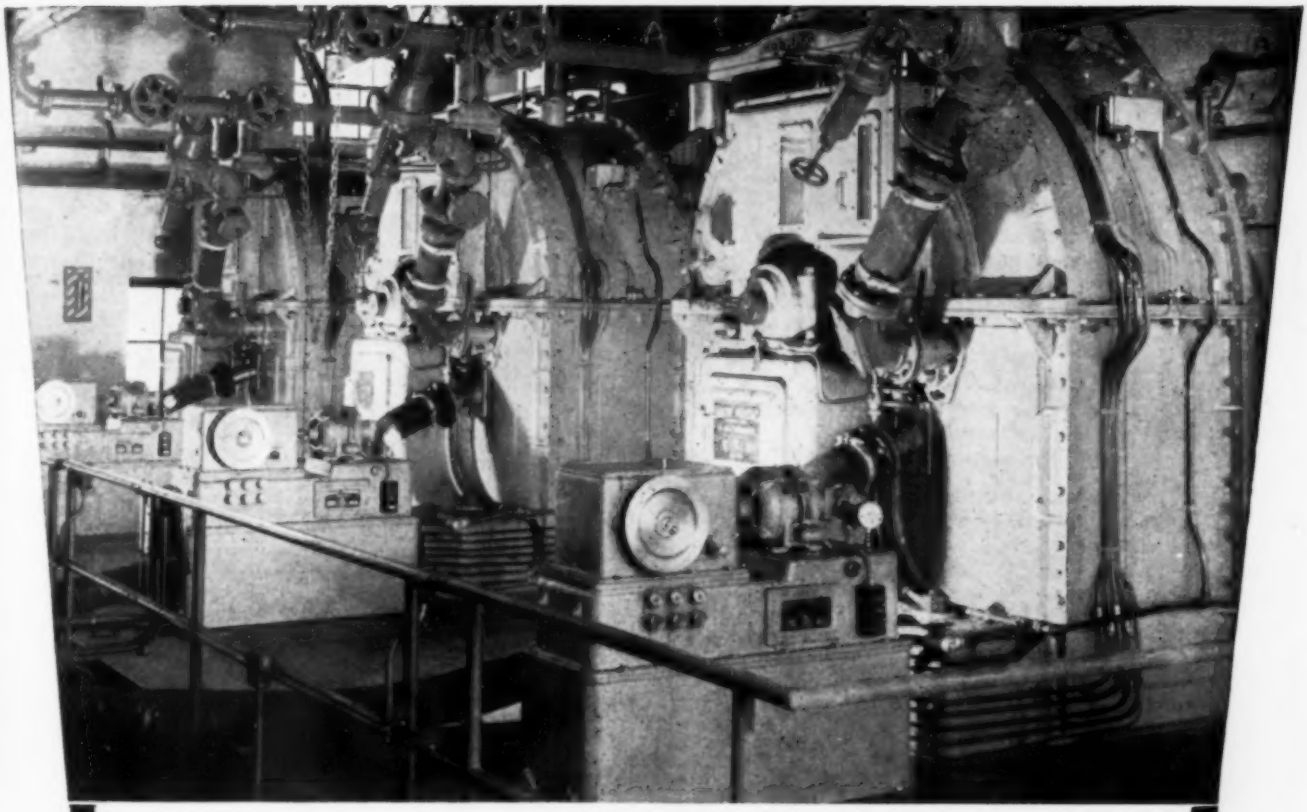
The point of greatest interest to the chemical industry in the commercial development of the hydrocarbon synthesis process is the relatively large volume of oxygenated products produced at the same time. For example, a synthetic gasoline plant with a capacity of 10,000 bbl. per day of gasoline would produce as co-products about 12,000,000 gallons annually of ethyl alcohol and approximately an equivalent quantity of other alcohols and acids.

H. G. Burks, Standard Oil Co. (N. J.), before the North Jersey Section, American Chemical Society, June 9, 1947.

FOREIGN LITERATURE ABSTRACTS

Polymerization of Isobutylene

Acid iron phosphates were investigated as catalysts for polymerization of isobutylene. Three types of solid acid phosphate-carbon catalysts were used: (1) a catalyst with pure $Fe(H_2PO_4)_3$ on carbon, (2) a catalyst with a mixture of orthophosphoric acid and of some monometallic salt of orthophosphoric acid on carbon and, (3) a catalyst with a mixture of almost equal quantities of monometallic and sesquimetallic salts, $FeH_3(PO_4)_2$, on carbon. On testing the action of these catalysts with isobutylene it was found that: (1) acid monometallic iron phosphate, $Fe(H_2PO_4)_3$, on carbon brings about polymerization of isobutylene but is very unstable, since it hydrolyzes readily. With freshly prepared catalysts the yield of diisobutylene is about 10 percent greater than with phosphoric acid, (2) a mixture of $Fe(H_2PO_4)_3$ with orthophosphoric acid is stable and gives a higher yield of dimer on the order of 80 percent of the polymer when the reaction is carried out in the range of 50-60 deg. C. Higher temperatures stimulate increased yields of



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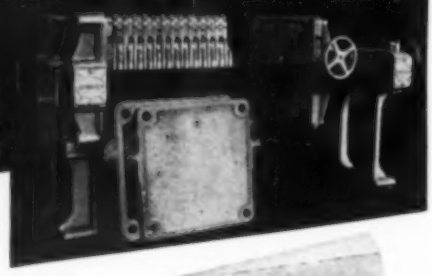

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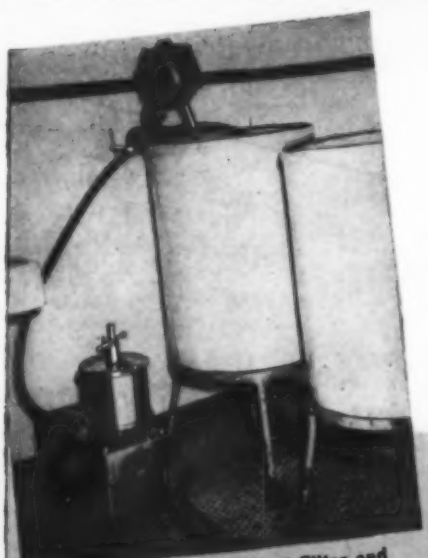

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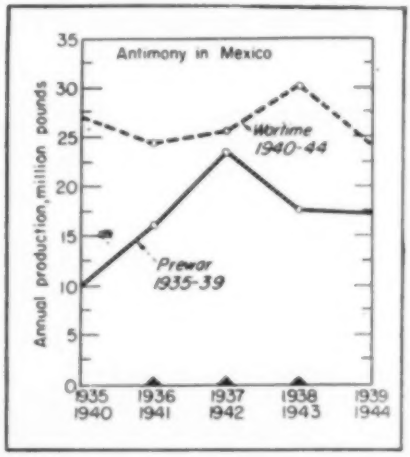
triisobutylene; (3) wetting isobutylene gives a high increase in the rate of reaction, particularly at 100-105 deg. C., but lessens the diisobutylene yield in the reaction products and leads to rapid exhaustion of catalytic activity.

Digest from "Polymerization of Isobutylene. II Action of Iron Acid Phosphates on a Carrier" by R. R. Halle, B. N. Parfanovitch and R. N. Rosenberg, *Zhurnal Prikladnoi Khimii* XIX, No. 12, 1251-1258, 1946. (Published in Russia).



Antimony Production in Mexico

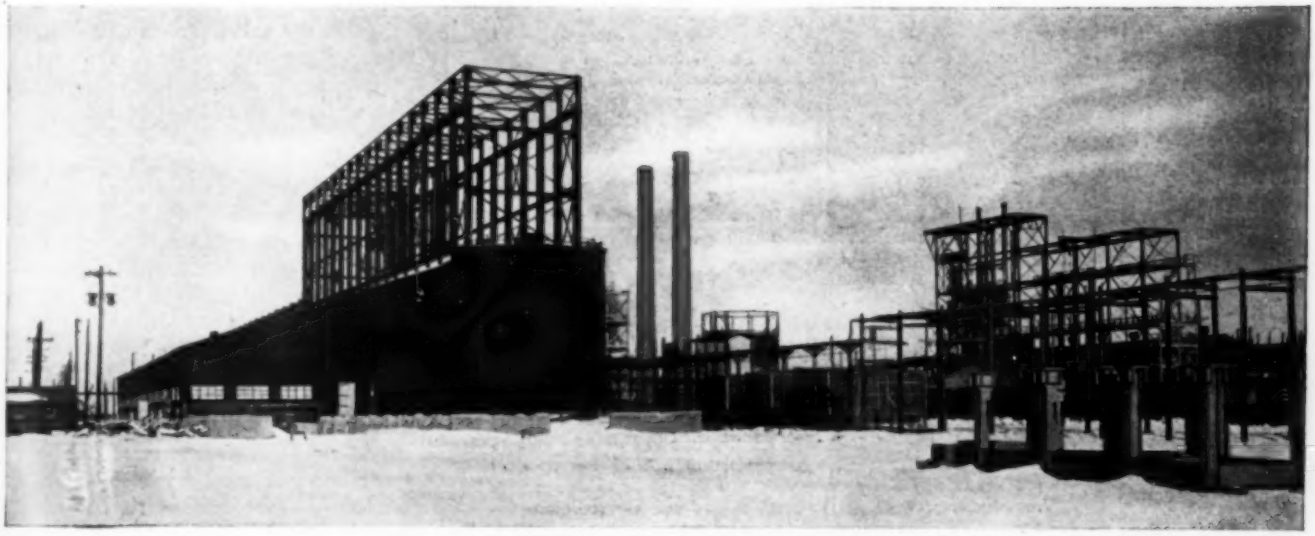
MEXICO and Bolivia are the largest producers of antimony in the Americas and produce more than the leading producers of the Old World: Yugoslavia, Algiers, Italy, Australia and Turkey. China had been the important producer before it was invaded by Japan. Mexican production of antimony began to increase in 1935. The attached graph shows the antimony production of Mexico before and during the war. The total production from 1893 through 1944 was 447,766,460. The principle antimony producing states of Mexico are the central states: Durango, Guerrero, Hidalgo, Jalisco, Mexico, Michoacan, Morelos, Puebla, Queretaro, San Luis Potosi and Zacatecas. In the north they are Chihuahua, Bajo California and Sonora, and in the south Oaxaca.

Digest from "Mexican Victory Minerals" by Eugenio Ysita, *Industria Minera* VI, No. 63, 61-65, 1946. (Published in Argentina.)

Electrolytic Preparation of Powered Nickel

CONCENTRATED electrolytes usually used in galvanotechnics have sufficient electroconductivity and effectiveness. The structure of the precipitate can be varied by change in the current density, but even with a considerable increase (up to 60 amp. per sq. dm.), these precipitates are obtained in a

No job for a novice



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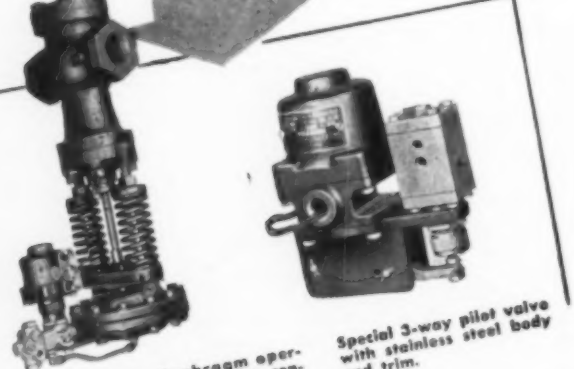

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compact form which is difficult to mill. Certain additions to the electrolyte affect the structure of the precipitates in different ways. Addition of ammonia at high D_k and t° C. promotes formation of brittle coats, but these baths are not very stable. Among capillarily active and colloidal additions, the worse results (in point of imparting brittleness to the precipitate) are obtained by application of saponin. The best results are obtained with urea and mixtures of urea and glycerine. Glycerine, solidol and "belting" (extract of linen) occupy an intermediate place. Soaproot, containing saponin, does not produce a stable foam on the surface of the bath and therefore cannot serve to protect the solution from the action of oxygen.

Mere reduction in the concentration of the electrolyte is not a sufficient measure for obtaining spongy, brittle precipitates, since a rapid increase in pH takes place in this case, at room temperature and with relatively high D_k, until it reaches a point where nickel hydrates begin to precipitate out of the solution. Electrolysis can be conducted at high pH without formation of hydrates by increasing the temperature of the solution to 50-60 deg. and introduction into the electrolyte of a double nickel-ammonium salt — $NiSO_4.(NH_4)_2SO_4.6H_2O$ —as an addition and as a basic salt giving ions of nickel. Fine-grained, brittle, easily removable dendrites and sponge are formed on the cathode.

Additions of urea ammonium thiocyanate and especially Rochelle salt to the electrolyte were found to be particularly favorable to the structure of the precipitated electrolytes of diluted solutions containing double amonium-nickel salt. In these additions, electrolysis can be conducted at room temperature and without stirring. The soft, powdered precipitates obtained here at high D_k are so highly dispersed that they do not require further grinding when removed from the solution. Electrolytic preparation of nickel powder gives a product which has a fairly low coefficient of activity (5-27 percent), which is affected very little by subsequent treatment. Conditions of electrolysis and the composition of the electrolyte affect this value to a considerable extent. The most expedient method for production of nickel powder with high activity was found to be the method of cathodic precipitation of the nickel in powdered form with subsequent annealing of the product in a current of hydrogen at fairly high temperatures.

Digest from "Electrolytic Method for Preparation of Powdered Nickel" by A. I. Levin, *Zhurnal Prikladnoi Khimii* XIX, No. 8, 779-792, 1946. (Published in Russia).

CHEMICAL ENGINEER'S BOOKSHELF

Lester B. Pope, ASSISTANT EDITOR

International Trade Policy

THE ALUMINUM CARTEL. *By Louis Marlio. Brookings Institution, Washington 6, D. C. 130 pages. $1.50.*

Reviewed by Gordon W. McBride

INTERNATIONAL trade in many commodities besides aluminum would be stimulated by the judicious use of cartels, in the opinion of the author. Basing his conclusions and recommendations on the 13 years during which he was chairman of the International Aluminum Cartel, Dr. Marlio speaks with authority of experience.

Explaining its sponsorship of this study, Brookings Institution says: "In a manuscript accepted for publication, the author has freedom to present his final interpretations and conclusions, although they may not necessarily be concurred in by some or all of those who cooperate with him or by other members of the staff. The Institution in publishing the work assumes the responsibility that it meets reasonable tests of scholarship and presents data and conclusions worthy of public consideration." Among the author's conclusions one finds the following:

Basic aim of a cartel is "stabilization in time of crisis, long-term reduction of prices, and expansion of the market through technical progress." These objectives, established and realized by the aluminum cartel, are identical with those of the most progressive, independent and competitive, manufacturing organization of this country, long adherent to the system of free competition. Central fact on which the divergence of view towards cartels is based in Europe and America is the difference in opportunity for large-scale industrial expansion in the United States compared with countries of restricted territory, population, and wealth, such as is typically the case in Europe.

Approximately half of the book is devoted to the four international aluminum cartels which have flourished since the first was established in 1901. The evolution of government policy toward those cartels is traced and in conclusion the author sums up the advantages which were realized. Those interested in economics and international trade in many segments of the chemical industry besides aluminum will find this book stimulating.

While the author admits that aluminum is one of the simplest commodities to adapt to cartelization, it is his feeling that international trade in general can best flourish through the medium of at least limited use of industrial cartels, coupled with regulatory measures designed to prevent abuses. Registration of all cartel agreements with each government and with the international organization is also recommended by Dr. Marlio, to avoid any appearance of secrecy and therefore "conspiracy against the public."

Reference Revised

UNIT PROCESSES IN ORGANIC SYNTHESIS. *Third Edition. By P. H. Groggins et al. McGraw-Hill Book Co., New York. 931 pages. $7.50.*

WHEN this standard reference work first appeared in November 1934, the synthetic organic chemical industry was on the verge of tremendous growth and expansion. "Unit processes," as contrasted with the older concept of unit operations, were relatively new and therefore not widely accepted. Today that terminology is standard throughout the world for as Mr. Groggins notes in his preface, foreign sales have almost equalled their record domestic distribution. His book has grown from 690 to 770 to 930 pages in its three editions. The current revision reflects greatly increased emphasis on the synthesis of aliphatic compounds and introduces several score of new diagrams and flowsheets related largely to outstanding wartime developments in the production of synthetic elastomers, aviation fuels, explosives, solvents, chlorinated hydrocarbons, surface active agents and plastics.

Recent Books Received

Developing Your Executive Ability. By H. Smith. McGraw-Hill. $2.50.

Heat Pumps. By P. Sport, E. R. Ambrose, and T. Baumeister. Wiley. $3.75.

Physikalische Chemie. By W. Kuhn. Wepf. 15 fr. (Swiss).

Fatty Acids. By K. S. Markley. Interscience. $10.

Metals and Plastics. By T. P. Hughes. I. Farnham. $4.50.

Bibliography of the Platinum Metals 1918-1936. By J. L. Howe. Baker. $5.

The Chemistry and Physics of Organic Pigments. By L. S. Pratt. Wiley. $6.

Strategic Minerals. By J. B. DeMille. McGraw-Hill. $7.50.

Why Silicones Tick

INTRODUCTION TO THE CHEMISTRY OF THE SILICONES. *By Eugene G. Rochow. John Wiley & Sons, New York. 137 pages. $2.75.*

WE WON'T belabor the point that the silicones are important. By this time everyone who cares must know that there are all kinds of silicones, that they are not long out of the laboratory, that they have some spectacular properties, and that they are finding one new application after another. Most people in the chemical industry also have at least a hazy idea of the way silicone polymers are constructed, with SiO groups in the keystone position somewhat like carbon atoms in organic polymers.

For many of us though that's about as far as our understanding goes. For some it may be enough. But there are among us many chemists, engineers, and product designers who, while not having time or incentive to become silicone experts, still can't afford to remain forever fuzzy and superficial in our comprehension of silicone chemistry. For us there is no better ticket than Dr. Rochow's. He is an authority, he is concise, and he is understandable. He can keep the Ph.D.'s interested without going over the sophomores' heads. There is a glossary. Dr. Rochow starts by describing the simple covalent compounds of silicon, goes from there into the organosilicon monomers, and from that groundwork leads into the industrially important silicones, the polymers.

Having covered the chemistry and properties of the silicones, Dr. Ro-

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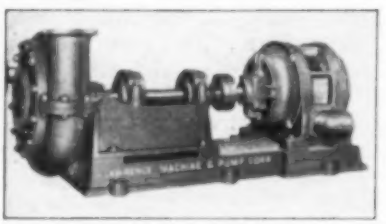

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chow is ready to tackle the technological questions of large-scale production and ultimate cost of the products. For this purpose, he re-examines the various methods of synthesis from the practical, rather than the purely chemical, point of view. The two processes that have achieved commercial status, Grignard and direct, are dwelled upon at some length.

Odor and Taste

THE CHEMICAL SENSES. *By R. W. Moncrieff. John Wiley & Sons, New York.* vii + 424 *pages.* $4.50.

Reviewed by Edward Sagarin

IN 1944 there appeared in London a study by a well-known British writer who had for years devoted himself to the development of the literature of cosmetics and perfumery. The new work of Moncrieff, entitled "The Chemical Senses," was surely his most ambitious; it was a comprehensive summary of the knowledge of the traditional senses of smell and taste, to which was added what G. H. Parker had termed the common chemical sense, consisting of sensibility to chemical irritants. The book now appears for the first time in this country, and constitutes an important asset to a chemical library, particularly where there is specialization in odorous materials, flavors, cosmetics, and food technology.

"The Chemical Senses" is all the more unusual a piece of work when it is considered that it is a gigantic task of scientific summation, addressed primarily to the chemist.

Opening his book with an evaluation of the role of the senses under consideration in the life of animals and man, the author follows with a biological study of each of these senses, the mechanism of sensation and the physiology of the organs involved. He then proceeds to a series of studies in the classification of odors, the relationship of odor and taste to chemical constitution, and an examination of the theories that have been propounded to explain the mystery of odor. In this respect, we know of no previous summaries as highly detailed and as well presented of the relationship of odor to chemical structure, and of the theories of odor, as are to be found in this book.

However, the very scope of Moncrieff's work was such that weaknesses were inevitable, and we found quite unsatisfactory the chapter on perfumes and essences. Here, Moncrieff links maceration and volatile solvent extraction, treating the two as variations of a single process; he confuses the terms "absolute" and "concrete"; and

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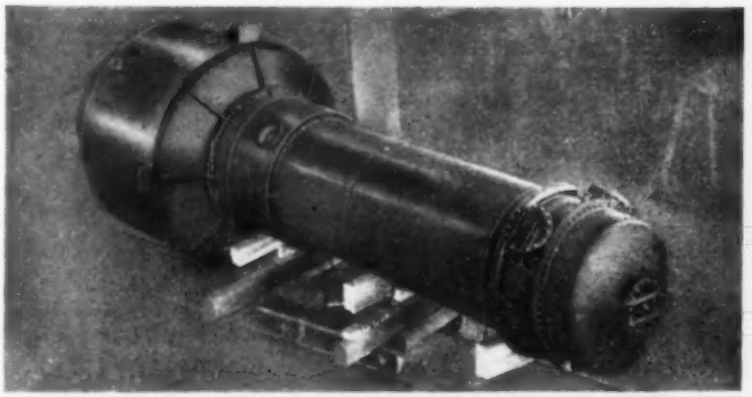
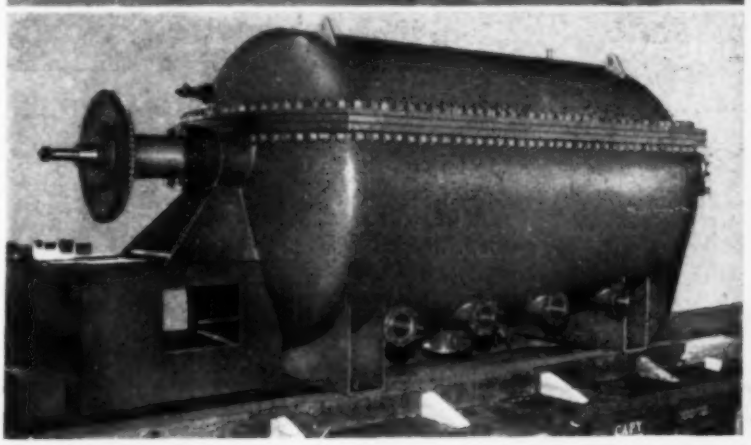
Shown here are several of the many diversified types of equipment recently produced at our modern plant in Birmingham for chemical process industries.

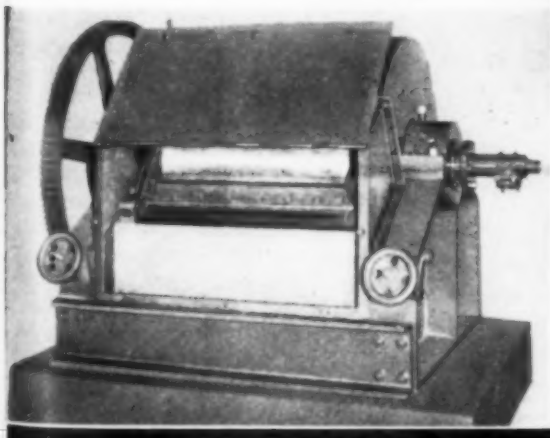
Right—Birmingham long tube, vertical film type Evaporator, being prepared for shipment. Body is one of a large multiple effect installation, each effect comprising 6,000 square feet of heating surface with vapor head 11'6" diameter.



Lower right—Special Rotating Leaf Pressure Filter, one of a group of four now in course of construction. This unit, affording over 1,000 square feet of filter area, is built to ASME Code specifications, entirely of stainless steel dressed with stainless steel cloth and tested to 300 lbs. per square inch pressure.



Below—G-B Flaker of special construction to customer's specifications. Nickel drum, alloy steel scraper and cooling water inlet and outlet nozzles on trunnion. Unit is completely enclosed during operation. G-B Flakers are available in all materials from 24" x 24" to 60" x 60".



WHETHER your needs call for standardized or highly specialized equipment, you will find us interested in handling your requirements and placing at your service the know-how gained in 66 years of design and building.

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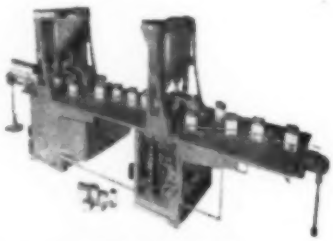
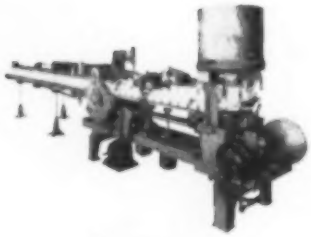
SEMI-AUTOMATIC FULLY-AUTOMATIC
SINGLE and DUPLEX TYPES

MATERIALS
Pastes—Powders
Granular Products
or any free-flowing
materials.

CAPACITY
¼ oz. to
10 pounds

PRODUCTION SPEED
15-30-60-120 per minute



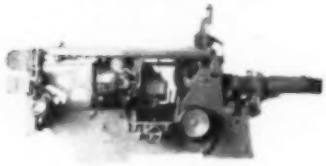


Several
Models

NEVERSTOP CARTON FILLER and SEALER

MATERIALS
All Food and Grocery Products
Capacity
Maximum Carton—10-½" x 6-½" x 4-½"
Minimum Carton—2-¾"x1-⅝"x¾"

PRODUCTION SPEED
40 to 120 per minute



TIGHT WRAPPING MACHINE Automatic

Tight wraps the package after it is filled and sealed.

Makes attractive, siftless, tight-wrapped package.

MATERIALS: All products in cartons

CAPACITY
Maximum Carton—10" x 6-½" x 4"
Minimum Carton—3-¾" x 1-½" x 1"
Production Speed: 60 to 70 per minute

Write for literature.

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for some reason he chooses a few oils, neither the most important nor the most typical, for detailed discussion.

In his material on odor classification, the author impartially reviews the contributions of Linnaeus, Zwaardemaker, Rimmel, Crocker and Henderson, and others, and avoids the pitfall of exaggerating the usefulness of any of these systems. To the work of Moncrieff on the subject, we might add that the basic failure of all odor classification systems is their ultimate dependency on the subjective reaction of smelling, resulting in a failure to have reproducible results. It was the great French scientist, Poincaré, who wrote, in "Science and Reality": "Now, what is science? It is above all a classification. . . . Science, in other words, is a system of relations. . . . Have these relations an objective value? . . . Are these relations the same for all? Will they still be the same for those who shall come after us?"

It is because we must answer Poincaré's questions in the negative that we find little science in the systems of classification that Moncrieff so ably summarizes.

High Polymers

PLASTICS, THEORY AND PRACTICE. *By Charles C. Winding and R. Leonard Hasche. McGraw-Hill Book Co., New York. 279 pages. $3.50.*

Reviewed by Richard F. Warren

HERE is a chemical engineers' book designed to take up where standard organic texts and handbooks stop. It gives a person becoming familiar with the technology of high polymers an opportunity to utilize his background and improve his knowledge of those high polymers which are now produced commercially or show promise of commercial application. The authors have purposely ignored laboratory curiosities. They discuss the formation and structure of high polymers with ample illustrations. The sections cover the classification of resins, the polymerization reaction, condensation, molecular weights, degree of polymerization, effect of structure, and the effect of plasticizers on linear polymers. General applications of resins, resins formed by high molecular weight natural products, resins formed by condensation reactions, polyethenic resins, silicones, rubber and synthetic rubbers are all discussed in concise terms.

The comprehensive use of schematic diagrams, flowsheets, sketches and photographs aid in conveying the authors' thoughts to the reader. This book will serve as a valuable asset to

You Wouldn't Pitch Hay
With a Shovel . . .

There's a *Right* tool for making emulsions, too!

Even a city slicker knows better than to tackle a haystack with a shovel. Profitable farming with minimum lost time means using the RIGHT TOOL for the job.

The same thinking holds true for emulsification jobs. But finding the right emulsifier is not quite so easy as choosing between shovel and pitchfork.

Making oil and water mix is often tricky chemistry. To begin with, the "oil" phase in a quality cosmetic is something quite different from the "oil" an insecticide chemist or food technician talks about. Then again, the proportions of oil and water in a cutting oil emulsion may be quite different from those in an emulsion for textile lubrication or for floor polish.

Naturally, no one emulsifier can do all emulsifying jobs equally well. That's why Atlas makes scores of surface active agents, including the well-known SPAN and TWEEN emulsifiers. But even this large range doesn't always hold the right answer, so Atlas maintains a "molecule-building" service to "construct" the precise surface active agent to fit your needs.

Span, Tween—Reg. U. S. Pat. Off.

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INDUSTRIAL CHEMICALS DEPARTMENT

CHEMICALS ATLAS EXPLOSIVES

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★ For fixed installations or portable use.

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Next time it happens, remember that you can pick up a copy of CHEMICAL ENGINEERING CATALOG and get the product information of many other less busy suppliers of the materials or equipment you're after. Further, this information is indexed by company *and* trade *and* product names... a triple-index which makes comparisons convenient, facts easy and quick to find.

Chemical Engineering Catalog cec

REINHOLD PUBLISHING CORPORATION

every chemist and chemical engineer interested in up-grading himself in the wide field of high polymers. The book crams a wealth of information into a relatively small number of pages. Although an expert in some phase may feel that the book spends too much time on fundamentals, the average engineer will find that the logical sequence of the presentation has much in its favor.

BRIEFLY NOTED

Modern Plastics Encyclopedia, Vols. 1, 2 and 3. Plastics Catalogue Corp., New York. 1,541 pages and charts. $8 in U. S., $11 in Canada, $12 abroad. The ever increasing available information and data on plastics has made it advisable to divide the catalog into three volumes. The first covers materials, coatings, films, synthetic fibers, laminates and technical data; the second volume covers engineering designs, molding, extruding, casting, fabricating, equipment and directories; and the third volume contains ten charts on various topics.

Helium. By W. H. Keesom. Elsevier Publishing Co., New York. 494 pages. $10. A comprehensive summary of the data known so far about helium, this book contains nine detailed chapters covering the gaseous, liquid and solid states, the helium atom and the helium nucleus. There are 258 illustrations.

Color and Color Mixing. By J. H. Bustanoby. McGraw-Hill Book Co., New York. 131 pages. $4.50. This guide for anyone concerned with the application of color provides a simple system for identifying a wide variety of today's standards, hues, tints, tones and shades and 242 formulas for mixing them. Descriptions of each are given and 96 are shown in actual color.

Methods of Vitamin Assay. Edited by the Association of Vitamin Chemists. Interscience Publishers, New York. 189 pages. $3.50. Compiled to promote the standardization of vitamin methods, these procedures coordinate the scattered literature and reports of personal experiences. Detailed analyses for vitamin A, carotene, thiamine, riboflavin, niacin and ascorbic acid are given. Also treated are sampling, other vitamin methods, and the use of check samples.

Guide to the Literature of Mathematics and Physics. By N. G. Parke. McGraw-Hill Book Co., New York. 205 pages. $5. People who are not primarily mathematicians and physicists but are engaged in fields where those sciences are playing roles of increasing importance will be able to make effective use of this classified guide. Books on aeronautical, electrical, radio and mechanical engineering have been included. Part I, General Considerations, offers suggestions to users who are not familiar with library techniques. Part II, The Literature, is a bibliography of about 2,300 entries under 150 subject headings. The basis of

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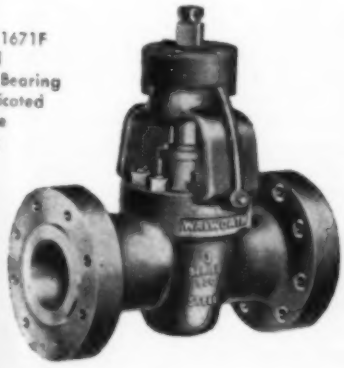

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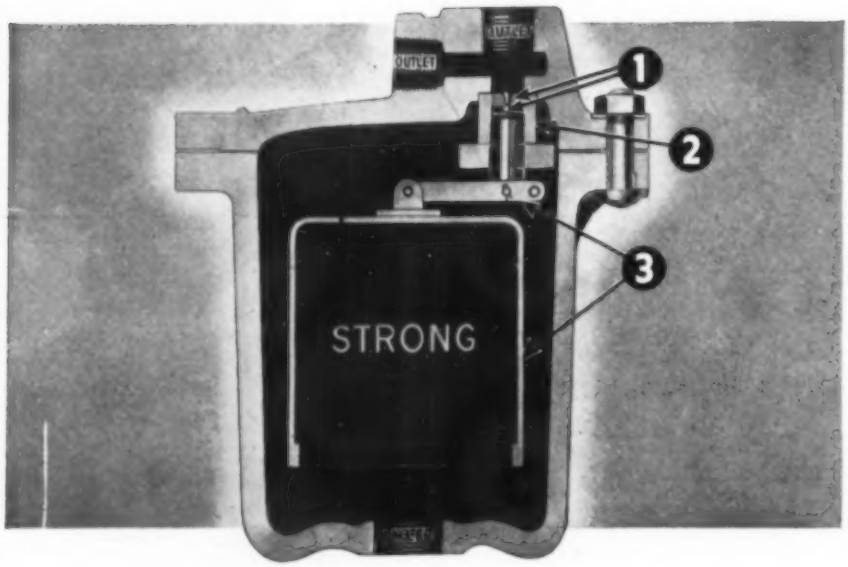
STRONG* Traps

are easy to maintain!



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Dual outlet simplifies piping, bottom inlet keeps trap cleaner. Years of trouble-free operation assured by super-STRONG construction.

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the selection is of practical interest, about half of the titles having come from the author's professional library.

Petroleum Production, Vol. III—Oil Production by Water. By P. J. Jones. Reinhold Publishing Corp., New York. 271 pages. $5. Statistical procedures reduce the numerous variables involved in the production of oil from water to a comparatively few factors. It is these—convergence, fluid factors, invasion factors, displacement factors and well interference factors—which are dealt with in the two parts of this book, Foundations and Applications.

Inorganic Syntheses, Vol. II. Edited by W. C. Fernelius. McGraw-Hill Book Co., New York. 293 pages. $4. Like Vol. I of the series, this book contains carefully checked methods of synthesizing nearly one hundred compounds. Brief articles on the preparation and properties of groups of inorganic compounds such as the rare earth salts and the heavy metal acetylacetonates are also included. The last chapter is an article on the nomenclature. The references are suggestive rather than exhaustive and the index is cumulative for Vols. I and II.

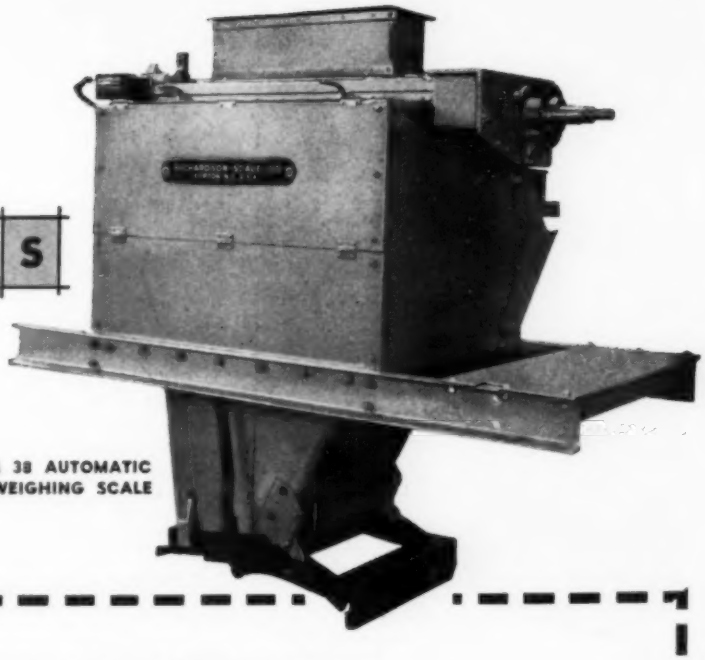
Qualitative Analysis by Spot Tests. Third edition. By F. Feigl. Elsevier Publishing Co., New York. 574 pages. $8. The entire literature on spot test analysis, including the newer reactions, has been assembled in this thoroughly revised volume translated from the German by R. E. Oesper. Designed to enable the reader to secure a rapid survey of the available spot tests and their applications, tested directions for carrying out the tests are an integral part of the text. Some new features are a section on technique and apparatus, a chapter on the detection of free elements and a bibliography on application for special scientific and technical purposes.

Microcalorimetry. By W. Swietoslawski. Reinhold Publishing Corp., New York. 199 pages. $4.75. This comprehensive description of the methods used in measuring small amounts of heat developed by different objects is perhaps the first of its type to be published. It contains eleven chapters covering such topics as methods of comparative measurements, the adiabatic microcalorimeter, static and kinetic methods of microthermal measurements and the labyrinth flow calorimeter.

Mathematical Aids for Engineers. By Raymond W. Dull. Published by McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y. 346 pages. $4.50. As far as practicing chemical engineers are concerned, only a few of Mr. Dull's 151 "aids" will be of bread-and-butter significance. Among his 28 chapters he deals with scales, logarithms, triangles, circles, vectors, complex numbers, energy, rotation, plane motion and differential equations.

Injection Molding of Plastics. By Islyn Thomas. Reinhold Publishing Corp., New York. 534 pages. $10. Here is a detailed, specific and practical coverage of the history, development, and mechanical problems involved in injection molding. The

get the right PROPORTIONS in every batch...



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Regardless of rate of flow or ratio of chemicals or other ingredients, you get desired proportions for batch mixes with a battery of Richardson Bulk Hopper Scales. Moreover, you get accurate weights as well as a uniformly blended product—and you get them speedily, automatically, with Richardsons. The Class 38 Bulk Weighing Scales:

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- Automatically discharge on a time schedule, pre-set for each material.
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- Automatically stop if any one scale runs out of material.
- Can be selected in or out of the system when batches are changed.

Speed processing and save manpower—cut costs in your vital handling operations of bulk materials and chemicals. Turn over the job of weighing, blending, and proportioning of borax, carbon blacks, clays, ores, minerals, salts, soda ash, potash, alum, etc. to Richardson Scales.

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For Use With Pyrometer Controllers

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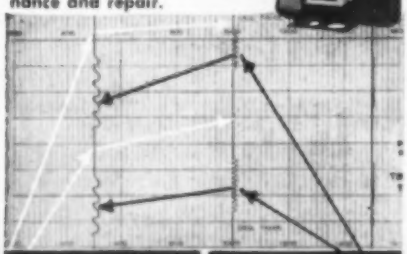
NO gears, cams, shafts, bearings or other rotating or sliding parts. Simple design eliminates usual maintenance and repair.



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author writes with competence and draws on his wide experience to give full practical discussion of important developments in designing, machining and utilizing molds with all types of plastics. In addition to a history and development of injection molding technics, the book covers materials used for injection molding, molding practices, product design, mold design and construction, finishing, decorating, estimating and costs.

Six-Place Tables. Seventh edition. By E. S. Allen. Published by McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y. 232 pages. $2.50. Squares, cubes, roots, logs, fifth powers, trigonometric functions, integrals.

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering publications noted in this list always give complete title and the issuing office. Remittances should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, pamphlet is free and should be ordered from the Bureau responsible for its issue.

Work Injuries in the United States During 1945. U. S. Department of Labor, Bureau of Labor Statistics, Bulletin No. 889. Price 10 cents.

Collective Bargaining with Associations and Groups of Employers. U. S. Department of Labor, Bureau of Labor Statistics, Bulletin No. 897. Price 10 cents.

Trade Practice Rules for the Household Fabric Dye Industry, as promulgated May 29, 1947. Federal Trade Commission. Unnumbered pamphlet.

Newsprint. U. S. Tariff Commission, War Changes in Industry Series, Report No. 22. Price 15 cents.

A Program for National Security. Report of the President's Advisory Commission on Universal Training. May 29, 1947. Price 75 cents.

Report on the Sulphur Industry and International Cartels. Summary, dated June 16, 1947. Federal Trade Commission. Unnumbered pamphlet.

Modern Turpentining Practices. By W. P. Everard. U. S. Department of Agriculture, Farmers' Bulletin No. 1984. Price 5 cents. Technic for use of sulphuric acid spray to increase yields.

Forest reports, available from U. S. Department of Agriculture, Forest Service.
Report 1. Gaging the Timber Resource of the United States.
Report 2. Potential Requirements for Timber Products in the United States.
Report 3. The Management Status of Forest Lands in the United States.
Report 4. Wood Waste in the United States.
Report 5. Protection Against Forest Insects and Diseases in the United States.
Contain statistics, technology, and economic conclusions.

Swinging-Shutter Apparatus for Measuring Small Dosages of Insecticidal

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Get the most out of your Spraying Equipment with minimum power . . . with efficient spraying.

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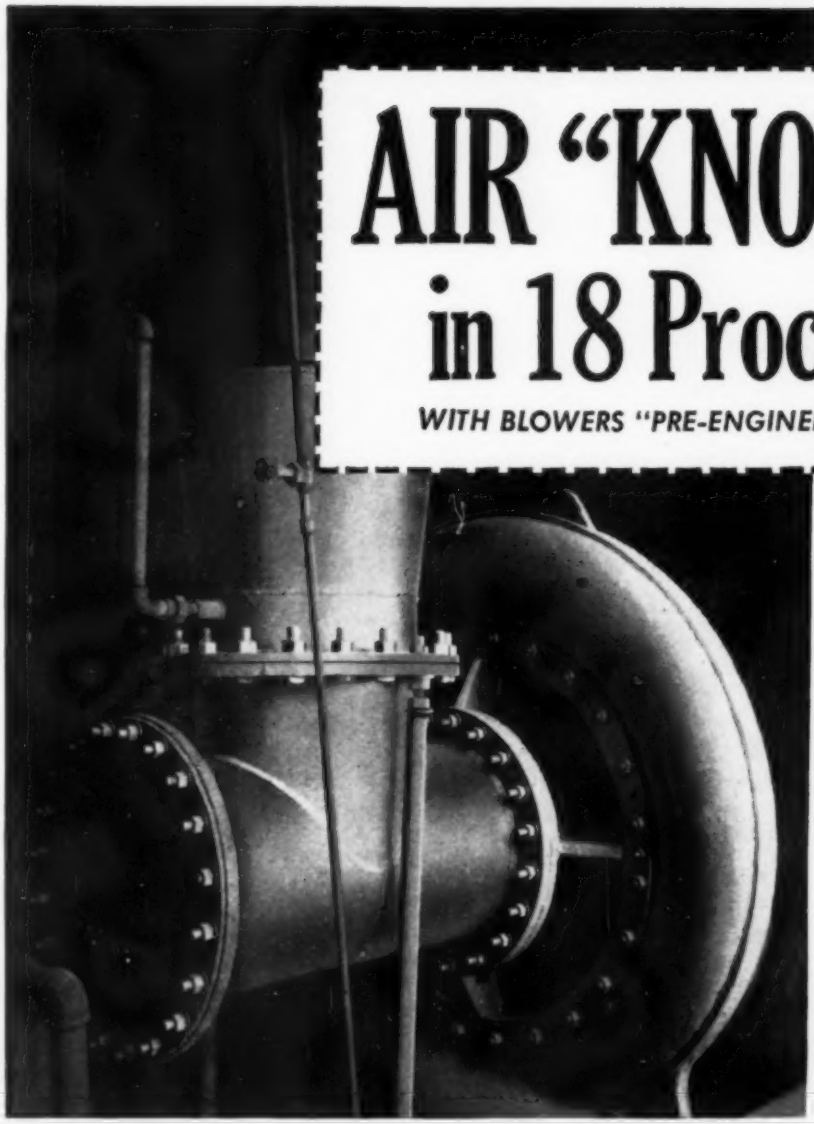
WITH BLOWERS "PRE-ENGINEERED" TO FIT YOUR NEEDS!



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- ★ Oil and Gas Fields
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- ★ Packing Houses
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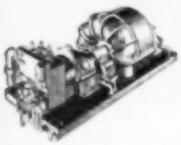
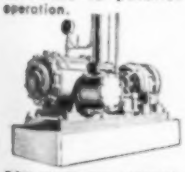
- ★ Pharmaeutical Mfg.
- ★ Rubber Factories
- ★ Sugar Refineries
- ★ Tanneries
- ★ Textile Mills

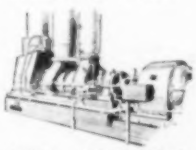


MULTI STAGE BLOWERS. Inlet volumes up to 130,000 cfm, pressure to 35 lbs gauge, uncooled. Pressure volume curve favorable to parallel operation.

ROTARY COMPRESSORS, sliding vane type. Capacities for 5 to 35 psi-g. Air is compressed in cells formed by blades moving freely in and out of longitudinal slots in rotor.



DRY VACUUM PUMPS. Range to 28½" hg vacuum. Same principle as rotary compressors except inlet is hooked up to chamber to be evacuated and exhaust is open.



AXIAL COMPRESSORS. Compress to 60 lbs. gauge with high efficiencies. *Good base load machines. Used with gas turbines.* Cannot build up dangerous pressures.

IN CHEMICAL AND FOOD Industries where equipment must be pre-engineered to handle highly technical processes, Allis-Chalmers offers the necessary know-how in building a blower that exactly meets the customer's needs.

Allis-Chalmers builds single and multi-stage turbo blowers as well as axial and rotary compressors and dry vacuum pumps to meet practically all pressure and capacity requirements.

A typical single stage blower is shown above. Use of cast casing provides rigidity, longer life, smoother operation, deadens machine noises and eliminates vibration. Operates on two bearings only . . . saves coupling and space. For higher pressure and greater volume, see multi-stage blower on left.

Allis-Chalmers in conjunction with process engineers has developed air and gas handling equipment to suit special process applications. It offers more than fifty years of experience in this field and in building high-speed machinery. Result: we can provide you with the blower you need, either standard or special.

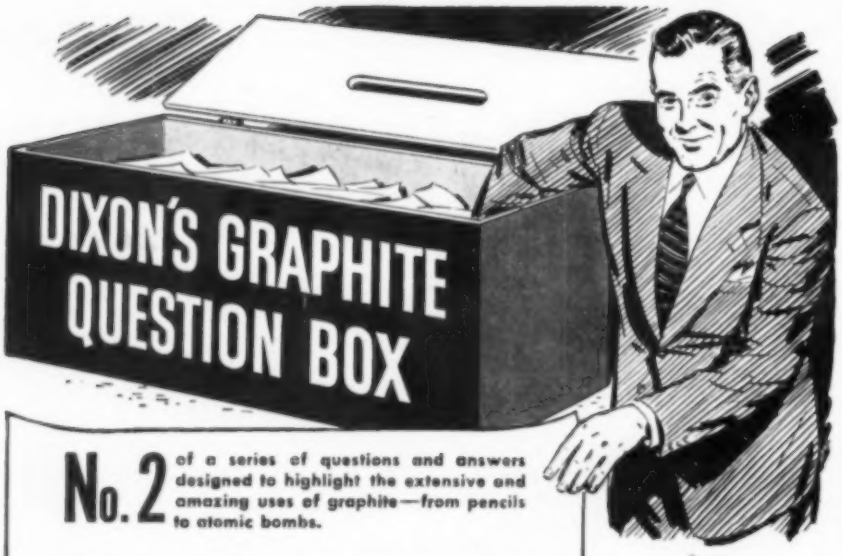
A qualified engineer is available in our nearby office to discuss how you can handle air or gas at lower cost. ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 2302

GET THE FACTS! Allis-Chalmers bulletin B6211 covers Rotary Compressors and Vacuum Pumps — B6048 Single Stage Turbo Blowers — B6104 Multi Stage units. Write for them.

ALLIS·CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

1847 1947 A CENTURY OF SERVICE to Industry THAT MADE America Great



DIXON'S GRAPHITE QUESTION BOX

No. 2 of a series of questions and answers designed to highlight the extensive and amazing uses of graphite—from pencils to atomic bombs.

HELPFUL ANSWERS FOR TECHNICIANS AND PRODUCT ENGINEERS

QUES. What are the principal characteristics of graphite?

ANS. Extremely unctuous. Lustrous and opaque. Withstands excessively high and low temperatures. Fusibility unknown but probably about 3000° C. Combustible in the presence of oxygen at about 620° C., but not altered by heating in a vessel free from air. Chemically inert. Good electrical and heat conductivity. Low co-efficient of expansion. Non-magnetic, non-fusible, non-toxic, non-odorous, and does not permanently stain. Specific gravity: 2.1 to 2.3. Moh's scale of hardness: less than 1.

QUES. What are *some* of the products or processes in or on which graphite is used?

ANS. Tungsten and molybdenum wire filaments
Steam and internal combustion engine cylinder lubricants
Hydraulic pump piston and piston rod lubricants
Extreme heat-and-pressure-resisting lubricants
Mechanical packings and gaskets, washers and sealing rings
Pipe joint compounds and seals
Brake linings
Paper (lubricating and transfer)
Typesetting machine mold, space band and mouthpiece lubricant
Wire drawing
Oil-less, self-lubricating bearings
Transmission chain lubricant
Transmission rope and cordage lubricants
Trolley wire lubricants
Protective surface coatings with lubricating qualities
Impregnated lubricating metals, plastics, rubber, felt, fabrics, leather, paper and wood
Lubricating bearing paste
Mechanical oven, lehr and kiln chain lubricants
Metal stamping, forging, tumbling and assembling lubricants
Lathe dead center and steady rest lubricant
Rolling mill lubricants
Quarry and mine machinery lubricants
Coal mine machinery lubricants
Lock lubricants
Firearm action and barrel lubricants
Cycle chain lubricant
Piano action and organ assembly lubricants

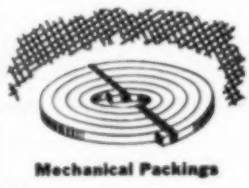
(To be continued in No. 3)

A few of thousands of widely used products containing Dixon's Graphites. Those starred are Dixon's products, many of them sold by supply houses everywhere.

★ Microfyne Flake Graphite

Cub . . 13¢

Type 4 . 40¢
★ Graph-Air Guns



Mechanical Packings

Now may we receive *your questions* on how graphite can help *you?*

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LOOK FOR No. 3
in this series. We will gladly send you reprints of any you may miss

Aerosal. By E. R. McGovran and J. H. Fales. Bureau of Entomology and Plant Quarantine, ET-239. Processed.

Preliminary Toxicity Tests with Nicotinium Salts. Nicotine Insecticides, Part IV. By E. L. Mayer, et al. Bureau of Entomology and Plant Quarantine, E-725. Processed.

Equipment for the Dispersal of DDT Insecticides by Means of Aircraft. By C. N. Husman, et al. Bureau of Entomology and Plant Quarantine, ET-228. Processed.

Rules of Practice in Trade-Mark Cases, effective July 5, 1947. U. S. Patent Office. Unnumbered pamphlet.

Electric Utility Depreciation Practices, 1945. Federal Power Commission, F.P.C.S-52. Price 25 cents. Order from Federal Power Commission, Washington 25, D. C.

Refractories. Publications by members of the staff of National Bureau of Standards. National Bureau of Standards, Letter Circular LC-852. Mimeographed.

List of Commercial Standards, revised to April 1, 1947. General Information. National Bureau of Standards, Letter Circular LC—853. Mimeographed.

Supplement to National Directory of Commodity Specifications. National Bureau of Standards, Supplement to Miscellaneous Publication M178. Price $2.25. Cloth.

Bibliography of Bureau of Mines Investigation of Coal and Its Products, 1940 to 1945. By A. C. Fieldner, et al. Bureau of Mines, Technical Paper 698. Price 15 cents.

Potash Mining in Germany, 1945. By J. H. East, Jr. Bureau of Mines, Information Circular I. C. 7405. Mimeographed.

Mercury Deposits of Southwestern Alaska. By Burr S. Webber, et al. Bureau of Mines, Report of Investigations R. I. 4065. Mimeographed.

Catron and Sierra Counties Tin Deposits, New Mexico. By M. E. Volin, et al. Bureau of Mines, Report of Investigations R. I. 4068. Mimeographed.

Iron Deposits, Iron County, Utah. By W. E. Young. Bureau of Mines, Report of Investigations R. I. 4076. Mimeographed.

High Alumina-Iron Laterite Deposits, Columbia County, Oregon. By James V. Kelly. Bureau of Mines, Report of Investigations R. I. 4081. Mimeographed.

Bessemer Iron Project, San Bernardino County, Calif. By F. J. Wiebelt. Bureau of Mines, Report of Investigations R. I. 4066. Mimeographed.

Description of Professions Series. Prepared by National Roster of Scientific and Specialized Personnel.
Pamphlet No. 1. Agricultural and Biological Sciences. Price 15 cents.
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Pamphlet No. 7, Social Sciences. Price 10 cents.

Chromite Deposits Near Red Lodge, Carbon County, Montana. By H. L. James. Geological Survey Bulletin 945-F. Price 25 cents.

Upper Cretaceous Ammonites from Haiti. By John B. Reeside, Jr. Geological Survey Professional Paper 214-A. Price 15 cents.

Manganese Deposits of the Republic of Haiti. By E. N. Goddard, et al. Geological Survey Bulletin 953-B. Price 15 cents.

Statistics of Higher Education, 1943-44. Biennial Survey of Education in the United States 1942-44. Chapter IV. By Henry G. Badger. U. S. Office of Education. Price 20 cents.

Thank you, Leonard!

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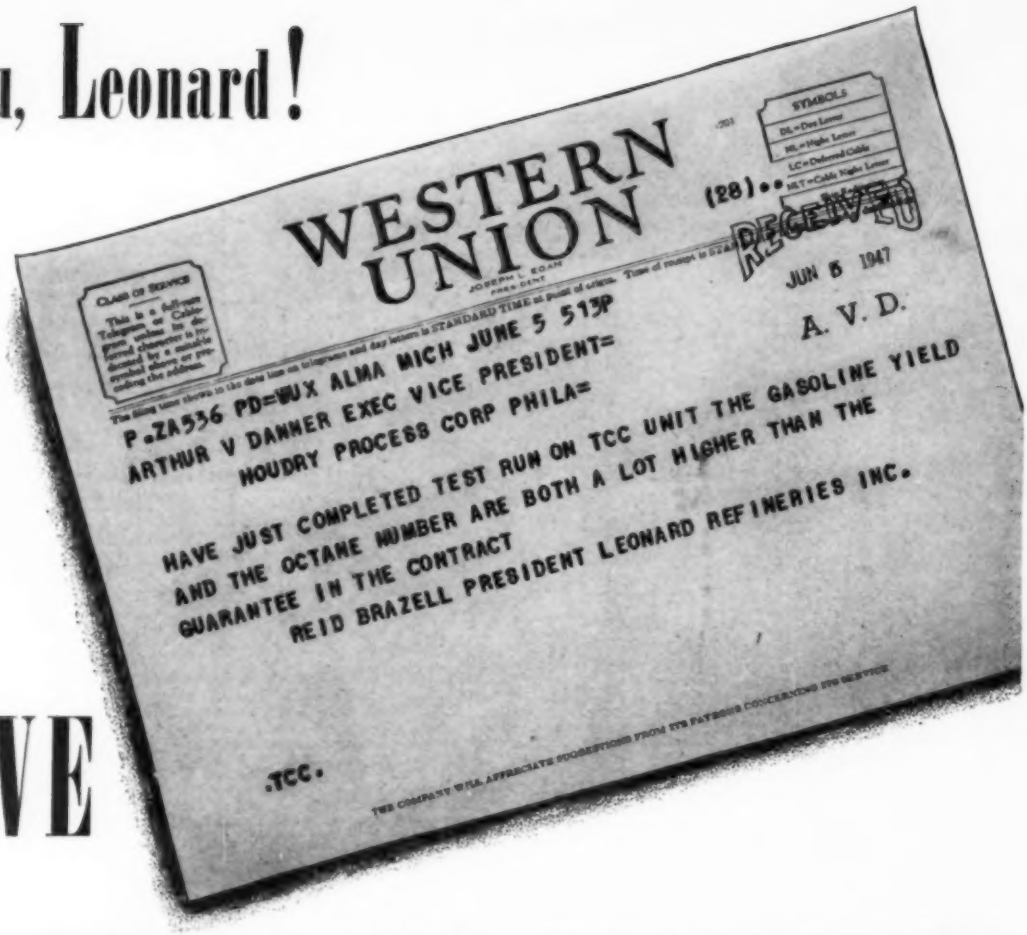
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Leonard Refineries' new 3,000 b/d T C C unit has completed its test run with results that are gratifying alike to Leonard and Houdry.

The successful performance of this first post-war small-scale T C C unit—and its extreme flexibility of operation—are no mere matters of chance or circumstance. Starting with T C C's inherent advantages of basic design, the unit has been well-planned, well-built, well-run. Every step of its development has been under the constant, close supervision of Houdry engineers.

We are grateful for Leonard's expression of complete satisfaction with its new small T C C. It is representative of the respect the industry holds for the processes and services of Houdry.

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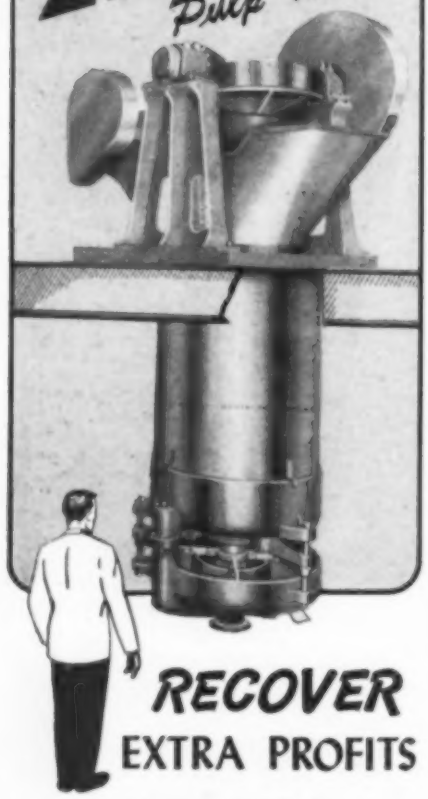

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100% continuous . . . from storage bin to pressed cake, the Zenith Pulp Press dewaters up to 26 tons of wet pulp per hour.

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MANUFACTURERS' LATEST PUBLICATIONS

Chemical Engineering's Readers' Service, in cooperation with manufacturers, makes it possible for you to secure catalogs, bulletins, and other publications herein listed without obligation (unless a price is specifically mentioned). For your convenience, publications may be obtained by using Reader Service Coupons on pp. 155-156.

(Continued from page 156)

and 15 in a series are case histories of paper bag packaging applications.

115. Textile Dyes. Calco Chemical Div., American Cyanamid Co., Bound Brook, N. J.—Bulletin 780 entitled "Studies of Wool Dyeing: Crocking" reports the results of studies made of a wide range of dyes.

116. Gas Analyzers. The Hays Corp., Michigan City, Ind.—Bulletin 45-743. 4-page leaflet diagramming and explaining the use of a high purity analyzer for carbon dioxide, oxygen and nitrogen.

117. Steel Welding Fittings. Tri-Clover Machine Co., Kenosha, Wis.—Catalog 747 contains 16 pages of data on physical characteristics, fabrication and adaptability of welding fittings. Includes tables of stainless steel analysis together with bursting pressure data and installation methods.

118. Petroleum Products. L. Sonneborn Sons, Inc., New York, N. Y.—A technical data file describing the characteristics and specifications of this company's petrolatums for industry.

119. Instruments. The Pyrometer Instrument Co., New York, N. Y.—Catalog 160 contains four pages of pictures and text describing a new surface pyrometer.

120. Instruments. Northern Equipment Co., Erie, Pa.—Bulletin 471. 8-page pamphlet containing diagrams and specifications of the Copes Type P regulator for remote boiler feed water control. The diagrams show the use of this regulator in different types of hookups.

121. Laminated Plastics. General Electric Co., Pittsfield, Mass.—64-page booklet providing complete information on the manufacture, application engineering and properties of all types of Textolite laminated applications. Lists 44 grades of the sheet material along with their electrical, physical and mechanical properties.

122. First Aid. Benson & Assoc., Inc., Chicago, Ill.—A series of cards covering the effects, treatment and protective equipment on many toxic chemicals used in industry.

123. Magnets. General Electric Co., Pittsfield, Mass.—35-page booklet giving information on permanent magnets. Contains technical data on characteristics, design, properties and applications.

124. Valves. Alloy Steel Products Co., Inc., Linden, N. J.—Catalog 47. 54-page booklet containing well-labeled cross sectional drawings of the types of valves made by this company and charts giving their dimensions. Includes a 4-page section on application data giving the corrosive medium, temperature, the type of valve to be used.

125. Dewaterizing. Hewitt-Robins Inc., Passaic, N. J.—Bulletin 129. 4-page leaflet explains the method by which the company's Eliptex Dewaterizer removes surface moisture from coal and other materials.

126. Welding. Ampco Metal, Inc., Mil-

Help for your
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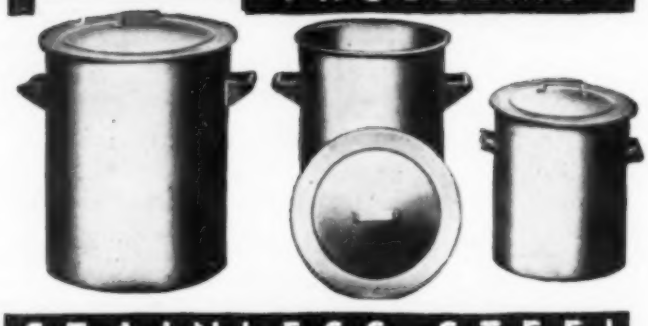

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• Solve many of your storage and processing problems with these rust-proof, acid resisting, easy-to-clean Stock Pots.

Made throughout of 16 gauge, 18-8 Stainless Steel welded construction, with all inside welds ground smooth and polished.

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These pots can be purchased with or without covers and if desired can be fitted with casters to make them portable.

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Because of their superior strength-weight ratios and other favorable properties, the low-alloy high-tensile steels are being used in increasing tonnages in the structural, manufacturing and transportation fields.

The McKay Company, anticipating that arc-welding would become the important method of fabricating low-alloy steels, has researched, developed and *now* is producing four electrodes—*Pluralloy* Nos. 70, 90, 100, 110—especially designed for welding the *hardenable* low-alloy, high-tensile steels.

Pluralloys operate much like stainless electrodes. Penetration during welding is moderate; a hot-arc insures excellent fusion of weld and parent metals; slag is fluid during welding and removes easily and completely on solidification. With proper manipulation *Pluralloy* Electrodes deposit weld-metal which is metallurgically free from porosity or slag inclusions.

PLURALLOY FEATURES

- *Pluralloys* deposit weld-metal in the welding of hardenable, low-alloy, high-tensile steels without danger of underbead cracking of parent metal.
- Four *Pluralloy* Electrodes cover a wide range of mechanical properties (70,000 to 110,000 psi minimum tensile strengths) in the weld-metal with a high degree of ductility.
- *Pluralloy* Electrodes are used in welding high carbon and high sulphur type steels which are usually difficult to weld.

FOR MORE INFORMATION

Data on welding low-alloy, high-tensile steels is available without obligation. Write today.

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When the going is ROUGH

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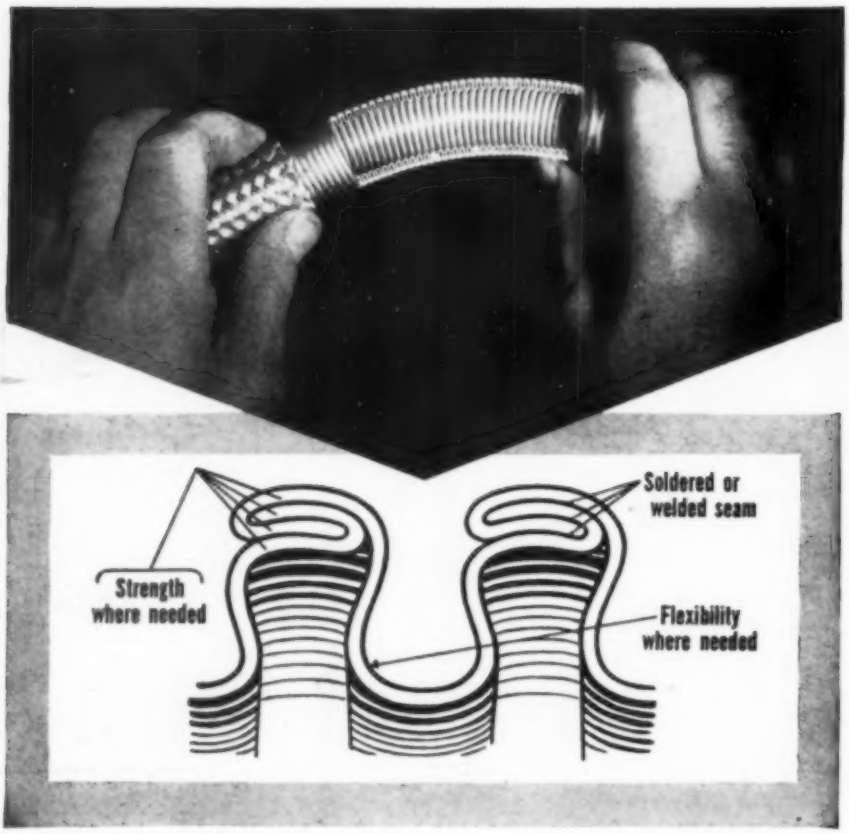

The drawing above illustrates exactly why Titeflex all-metal flexible tubing stands up under the most rugged conditions.

Note that there are *four* thicknesses of metal at the top of each convolution—right where the greatest wear is encountered.

Note that flexibility is achieved by wall construction without deforming or stretching the metal. There are no packed, sliding joints to wear out or decompose.

Note that the metal strips are soldered tightly together to prevent leakage of both gases and liquids.

Note that Titeflex tubing is *all metal*—it is unaffected by gas, oil or liquids . . . and withstands high temperatures. Yet it is fully flexible and holds up under excessive vibrations.

Your are invited to make full use of the Titeflex research laboratories and engineering service in solving your tubing problems. Write today for full information. Catalog on request.

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waukee, Wis.—Bulletin 68B contains 24 pages cataloging a line of spot welder tips and holders, seam welder wheels and other resistance welding accessories.

127. Cutting Steel. Air Reduction Co., New York, N. Y.—12-page reprint covering the fundamentals and capacities of their Flux-Injection method of cutting steel.

128. Gaskets. Armstrong Cork Co., Lancaster, Pa.—20-page booklet contains numerous tables and graphs giving the properties of the various cork, cork-and synthetic-rubber, and synthetic rubber gasket materials. Includes recommendations for selection of sealing materials.

129. Tubes. Wallace Tube Co., Chicago, Ill.—68-page data book on the properties of tubular products. Includes A.S.T.M. specifications, pressure tubes and tables of sizes and weights. The book has an index tab design.

130. Magnets. The Homer Manufacturing Co., Inc., Lima, Ohio.—6-page leaflet explaining the styles of permanent magnetic separators and pulleys made by this company.

131. Steel. Allegheny Ludlum Steel Corp., Pittsburgh, Pa.—30-page booklet describing the uses of stainless steel in the meat packing industry. Includes a corrosion resistance chart of this steel to various media. Also available are booklets on the uses of stainless steel in the dairy and petroleum industries.

132. Building Maintenance. Continental Asbestos and Refining Corp., New York, N. Y.—32-page illustrated catalog outlining specific maintenance problems and explaining how this company's products may be used to solve these problems. Contains information on products for preserving and improving floors, protective and decorative coatings for interiors and exteriors of buildings, heating systems, and industrial cleaners and disinfectants.

133. Economic Planning. The Hydraulic Press Manufacturing Co., Mount Gilead, Ohio.—10-page booklet discussing the pitfalls of production at the present time and some suggestions for avoiding them.

134. Nickel. The International Nickel Co., Inc., New York, N. Y.—In reprint form this compressed handbook provides information on nickel, Monel, Inconel and associated alloys.

135. Heating Mantles. Glas-Col Apparatus Co., Terre Haute, Ind.—Bulletin 1. 16-page booklet describing the Glas-Col line of electric heating mantles.

136. Centrifuges. Centrifuge Mechanical Equipment, Inc., Hoboken, N. J.—4-page flyer giving specifications and drawings of this companies centrifuge units.

137. Chemicals. Wright Chemical Corp., Chicago, Ill.—4-page leaflet describing the chemicals manufactured by this company for conditioning aqueous systems to inhibit corrosion.

138. Calculator. Tube Turns (Inc.), Louisville, Ky.—A sliding cardboard calculator designed on one side to find flow criterion and friction factor correction and on the other side the tube-turn velocity and pressure drop of liquids and gaseous fluids.

139. Aluminum. Reynolds Metals Co., Louisville, Ky.—32-page booklet describing the use of aluminum in heating, ventilating and air conditioning.

140. Resins. Resinous Products & Chemical Co., Philadelphia, Pa.—Two booklets on this company's Paraplex resins. The first discusses synthetic polymers of the thermosetting polyester type which are used for laminating and casting. The second describes non-migrating polyesters used as free films and extruded compounds.

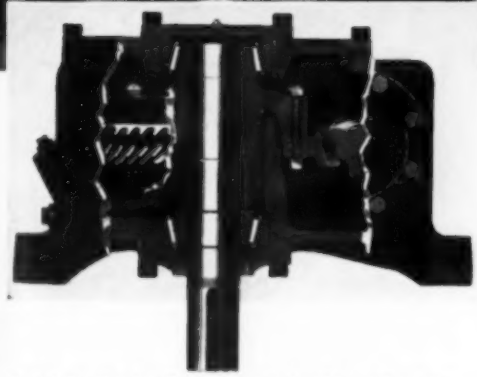
141. Motors. Electric Machinery Mfg. Co., Minneapolis, Minn.—16-page booklet the synchronous motor driven compressors of this company. Contains cross sectional drawings. Explains how to figure voltage drop.

142. Adhesives. Paisley Products, Inc., New York, N. Y.—4-page leaflet illustrating and describing can labeling adhesives.

143. Regulators. Leslie Co., Lyndhurst, N. J.—Bulletin 468. 4-page leaflet listing in table form the internal working

The Customer says:

"...Philadelphia Speed Reducers were used because they were so admirably suited to the application from the standpoint of performance as well as appearance"



Special attention is called to the exclusive "dry well" construction, which *prohibits oil leaks* down the vertical shaft—thus no *contamination or discoloration* of the contents of autoclaves mixing kettles, vats or agitator tanks is possible. Also, no internal lubrication of the reducer is lost. Attention is also called to the *simplicity, compactness* and *ruggedness* of these heavy-duty units. Worm and gear, shafts, bearings, etc. are all of the best materials available and accurately machined.

Yes, the Vice-President of Steel and Alloy Tank Co. of Newark, N. J. made the above kind remarks regarding the Philadelphia Type "VT" Vertical Drive Speed Reducing Unit (sectional view at left). These Reducers are used for driving agitators in mixing tanks and are mounted on top of heavily built kettles used in the production of explosive products.

Incidentally, Philadelphia Worm Gear Reducers are available in all types, —with drive shafts operating at *top* of reducer; at *bottom;* vertically up— and vertically down.

Thousands upon thousands of Philadelphia Worm Gear Units are in use throughout the World (as are other geared types of our Reducers). Send for Worm Gear Reducer Catalog, #26, and please use your Business Letterhead when requesting same.

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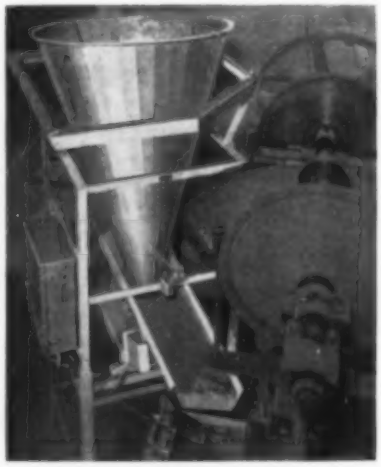
DRY FEEDER MACHINES

with vibrated, non-arching hoppers, for the



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of dry, bulk materials to processing machinery.

Complete units, ready for operation, having a vibrator on the supply hopper to assure a constant supply of material to the vibrating feeder

Rheostat control permits regulation of feed from a trickling dribble to a gushing torrent.

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Type "SAL" Steam Atomizing Oil Burner assures high fuel capacity . . . thus reducing the number of burners needed. Because of thorough atomization, it produces a clean, steady, well-defined flame, which completely burns the fuel oil. Type "SAL" Oil Burners are adaptable to dual fuel systems on large boilers . . . are frequently used to fire fuel oil above existing coal stokers. For detailed information—write for Bulletin 24.

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parts of regulators that are renewable and interchangeable.

144. Blowers. Lamson Corp., Syracuse, N. Y.—Bulletin B-5. 20-page booklet on blowers and exhausters of the centrifugal type. Contains capacity tables, features of design and general specifications.

145. Capacitors. Aerovox Corp., New Bedford, Mass.—Two loose-leaf pages 30A and 30B on mica capacitors are available for insertion in this company's Transmitting Capacitor Catalog.

146. Pumps. Byron Jackson Co., Los Angeles, Calif.—4-page bulletin on a centrifugal type pump designed to handle hydrocarbons for bulk station service. Contains a cross sectional drawing showing construction and operating features.

147. Incinerator. Plibrico Jointless Firebrick Co., Chicago, Ill.—4-page leaflet describing a rubbish destructor with an air-cooled lining.

148. Welding. Ampco Metal, Inc.—Two welding procedures for tin bronzes and brass. Describe the use of bronze welding electrodes in joining and overlaying these alloys.

149. Heat Treating. Rockford, Ill.—4-page leaflet discussing operation of an automatic heat treating unit.

150. Turbines. Elliott Co., Jeannette, Pa. —Bulletin H-16 describes this company's Type YR mechanical drive turbines. Contains general and material specifications and table of frame dimensions contains cross sectional drawings of turbines and governors.

151. Water Treating. American KAT Corp., New York, N. Y.—4-page reprint of an article describing this company's colloidal water conditioning and a case history of its application to a specific power plant.

152. Pumps. Morris Machine Works, Baldwinsville, N. Y.—16-page booklet describing Morris' Type-R slurry pumps. Contains cross sectional views of right and left hand pumps with discharge nozzle swiveled to meet various requirements. Includes five graphs each showing the brake horsepower against the specific gravity for a different sized pump.

153. Dryers. Link-Belt Co., Chicago, Ill. —12-page booklet showing diagrams of layouts for dryers using gas, steam and oil fired heaters. Contains chart of dimensions of dryers.

154. Instruments. Bailey Meter Co., Cleveland, Ohio.—Bulletin 233. 4-page leaflet on area meters for measuring rates of fluid flow. Transmitters are diagrammed and their dimensions and other data are presented in a chart. Bulletin 231 describes and pictures electronic recording instruments giving diagrams of various circuits.

155. Stills. Distillation Products, Inc., Rochester, N. Y.—16-page brochure presenting information on high vacuum distillation. Includes graph of inverse of absolute temperature plotted against logarithms of the pressure of various specimen substances as guide in selection of stills.

156. Engines. Troy Engine & Machine Co., Troy, Pa.—8-page booklet describes and pictures vertical engines. Includes chart giving engineering data.

157. Welding. McKay Co., Pittsburgh, Pa.—Manual presenting specifications, operating characteristics, mechanical properties, a conversion table and other data for this company's line of shielded-arc electrodes for the welding of mild-steels and alloy-steels.

158. Filters. T. Shriver & Co., Harrison,

FOR MORE INFORMATION

See Reader Service

Coupon on pages 155-156

Auto-Lite Indicating Thermometer F-1, illustrated, can be supplied with adjustable, electrical alarm contacts at small additional cost. Hooked up with a bell transformer circuit, it gives a warning bell or light signal when temperature rises above desired level.

. . . Use this Precision-made Auto-Lite Thermometer in Operations where Temperature is Important!

"Taking temperature" is easy when you have Auto-Lite Indicating Thermometers. All you have to do is to mount the dial head where readings can be taken most conveniently. The capillary tubing permits temperature to be observed at some distance from the temperature source, even in another room if necessary. In power plants, in the processing of chemicals and foods, and in all other operations where uniform temperature is important, Auto-Lite Indicating Thermometers help to save money, time and materials. Install them for greater efficiency.

AUTO-LITE
RECORDING THERMOMETERS

Model "500" is designed for use where accurate charting of temperature is needed. In service, it complements the F-1 Indicating Thermometer for food lockers, quick freezing and other low temperature applications. Model "500" Recording Thermometers have either 24 hour or 7 day mechanical clock movement. Highly visible, 6" chart, with exceptional range coverage. Capillary tubing permits remote reading. Further details on request.

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Williams

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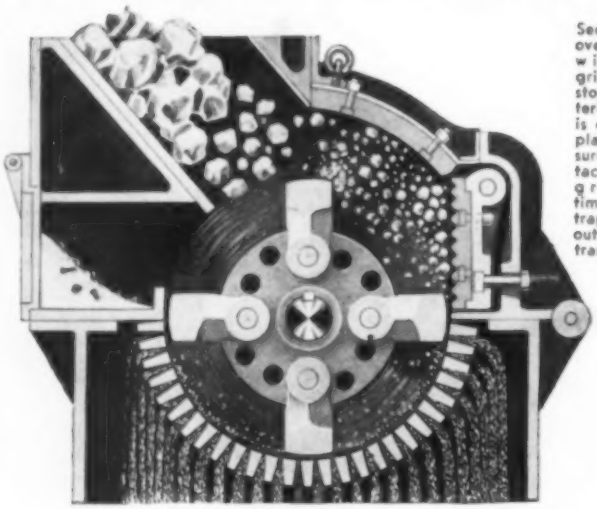
HEAVY DUTY HAMMERMILLS



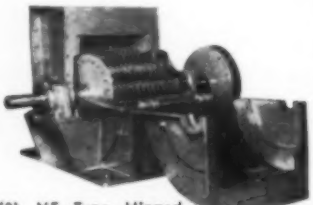
Sectional view of Williams over-running hammermill with heavy liners and grinding plate for limestone and other hard material. Particular attention is directed to the grinding plate adjustment which assures uniform close contact of hammers and grinding plate at all times. Also note the metal trap which provides an outlet for the escape of tramp iron.

Reduces
ANIMAL
MINERAL
VEGETABLE
MATTER

STANDARD MACHINES for Practically Any Reduction Job

(1) Williams HM Type Pulverizer.

CHEMICALS, SOAP CHIPS, ETC. Hundreds of chemicals are being ground with the machines shown here.

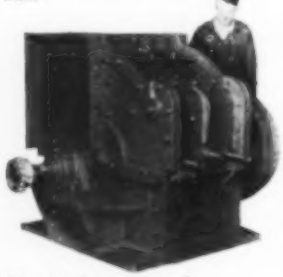


(2) NF Type Hinged cover has been opened showing interior of mill.

OIL CAKE, INCLUDING SOYA, COPRA AND COTTONSEED. Expeller cake as well as hydraulic press cake is satisfactorily ground for animal food.

ANIMAL AND FISH BY-PRODUCTS. Thousands in operation grinding cracklings, tankage, fish scrap, raw and dry bones, etc.

GARBAGE, SEWAGE. Many in operation grinding garbage from municipalities and canneries.



(3) Another view of NF Type. Notice heavy flywheel at right.

STEEL, ALUMINUM AND OTHER METAL TURNINGS. All can be easily handled in Williams Mills to permit easier handling by conveyor or shovel.

ROOTS, HERBS, BARK AND CHIPS. Various vegetable substances can be successfully shredded previous to extraction processes.

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N. J.—Bulletin 123. 4-page leaflet describing filter media manufactured by this company.

159. Liquid Level Floats. Armstrong Machine Works, Three Rivers, Mich.—4-page circular describing high side floats for discharging liquid refrigerant to low side of refrigerating systems. Includes diagrams of operating principle and chart of physical data and list prices.

160. Chemicals. Fritzsche Bros., Inc., New York, N. Y.—12-page booklet listing prices of essential oils and aromatic chemicals handled by this company.

161. Pumps. American Brake Shoe Co., Chicago Heights, Ill.—Bulletin 547-IP, 8-page booklet pictures a ball-bearing, Type T, pump. Shows start-to-finish assembly of pump and diagrams and cross sectional views explain its features.

162. Tools. B. F. Goodrich Co., Akron, Ohio.—Catalog leaflet describing the line of rubber mallets made by this company.

163. Liners. Ajax Electric Co., Philadelphia, Pa.—4-page reprint entitled "Austempered Cast Iron Serves as Cylinder Liners".

165. Filters. Titeflex, Inc., Newark, N. J. —4-page flyer giving the capacities, and features of construction of this company's filters.

166. Connectors. Timber Engineering Co., Washington, D. C.—12-page booklet providing instruction on the installation of timber connectors.

167. Welding. Handy & Harman, New York, N. Y.—Bulletin 15. 4-page leaflet describing a silver brazing alloy. Contains chart showing tensile strengths.

168. Equipment. American Brake Shoe Co., Chicago Heights, Ill.—Bulletin 547-DS. 40-page booklet picturing and describing manganese steel parts and equipment made by this company.

169. Power Transmission. The Hilliard Corp., Elmira, N. Y.—Bulletin No. 231. A 6-page illustrated booklet describing the over-running clutch and coupling equipment manufactured by this company. Contains detailed description of the construction, operation, installation and other valuable data. Cross-sectional diagrams show the construction features, and tables of dimensions and capacities are included.

170. Textile Processes. Calco Chemical Div., American Cyanamid Co., Bound Brook, N. J.—Bulletin 778 entitled "Importance of pH control in Wool Processing."

171. Fire Protection. Cardox Corp., Chicago, Ill.—4-page folder illustrating and describing fire protection equipment. Describes in detail how fire protection may be obtained by use of this equipment.

172. Boiler Equipment. The Deming Co., Salem, Ohio—24-page bulletin No. CR-1 describes a complete line of condensation return units and boiler feedpumps. Gives information on various types of units and contains a selection table to simplify the selection of the proper units to meet the various steps of operating conditions.

173. Varnish-Making Equipment. Brighton Copper Works, Inc., Cincinnati, Ohio—Catalog No. 11. 2-page illustrated booklet describing varnish-making equipment including set kettles, portable kettles, kettle trucks, synthetic resin kettles, heating and cooling systems. Various pieces of equipment are described and illustrated with photographs. Dimensional drawings are included and a group of sketches show standard shapes of portable kettles, methods of supporting kettles, as well as the various types of set kettles, and set kettle bottoms. Dowtherm heating systems for this work are described and illustrated with flow diagrams.

174. Prefabricated Insulated Pipe Units. The Ric-wil Co., Cleveland, Ohio—Form 4626. 16-page booklet giving specification data on prefabricated insulated pipe units. Contains detailed drawings and sectional views, together with tables of dimensions. This material is given in data sheet style. Contains curves showing expansion for steel and rod iron pipe loops. The method of installation is described and illustrated in detail step by step. This booklet appears to have complete data for use by engineers and architects who design systems using this type of insulated pipe unit.

CHEMICAL ECONOMICS

H. M. Battors, MARKET EDITOR

THIRD-QUARTER OUTLOOK FOR CHEMICALS FAVORED BY CURRENT POSITION OF CONSUMING OUTLETS

TOTAL industrial production in the first half of 1946 was greatly affected by labor troubles and other adverse factors which were less in evidence in the six months recently completed. Under the general and more favorable conditions which prevailed in domestic markets and with exports holding a high level, total domestic production made progress with the indexes of the Federal Reserve Board registering a gain of more than 15 percent for the 1947 period. On the same authority, production of industrial chemicals likewise moved forward but the rate of increase in the first half of this year was less than 12 percent. The *Chemical Engineering* index for consumption of chemicals moved closely in line with that for all production with an indicated increase over the first half of 1946 of close to 15 percent.

Both production and consumption of chemicals, in the first half of this year, have maintained a level considerably above that reached when wartime activities were at their height. Throughout the war years, a high percentage of the products turned out in the chemical process field, was earmarked for use in the war effort. These were products ordinarily produced for civilian consumption. Their diversion into other fields meant that civilian requirements were but partially filled and civilian inventories became practically nonexistent. With the return to normal trading, the backlog of civilian orders forced producing plants to continue capacity operations.

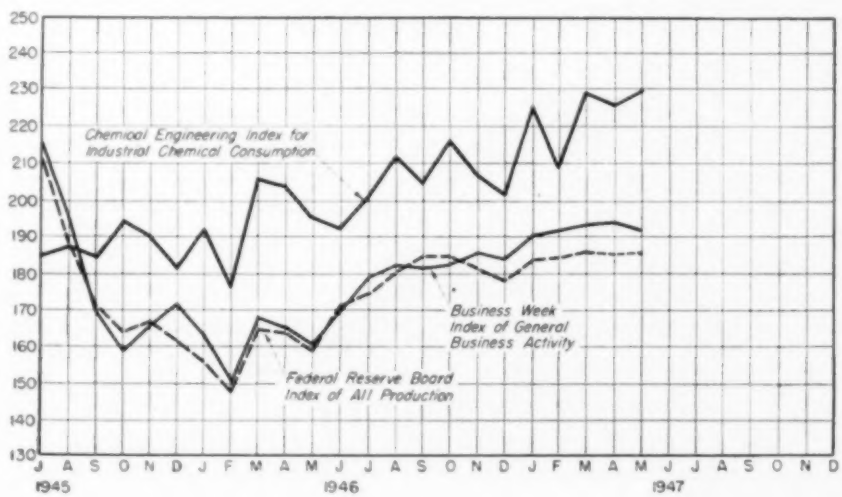
Rehabilitation of equipment together with the completion of new productive units laid the foundation for an upward trend in production which was further aided by the transfer of many government plants to industry and the removal of controls on the movement of raw materials. The high rate of activities has gradually cut down the disparity which formerly existed between supply and demand and in some instances has created a fair semblance of balance with increasing reports of stock accumulations although the latter, in the case of chemicals, are more true of specialties than of the heavy tonnage items.

In the latter part of June and the early part of July a tapering off was reported in many producing and consuming lines but more recent reports have indicated that the vacation period for plants has ended and that shipping instructions for contract deliveries of raw materials have come back to normal. The huge outputs in the first half year, however, bring the implication that the rate has been too high to be sustained over any long interval. Furthermore, the buying pattern is changing as inventories climb back to a normal position and new orders are based more on replacement needs than on filling current requirements plus stockpiling. Consideration also must be given to the rise in production in outside countries and to the dwindling dollar credits which sooner or later must be reflected in the volume of our export trade.

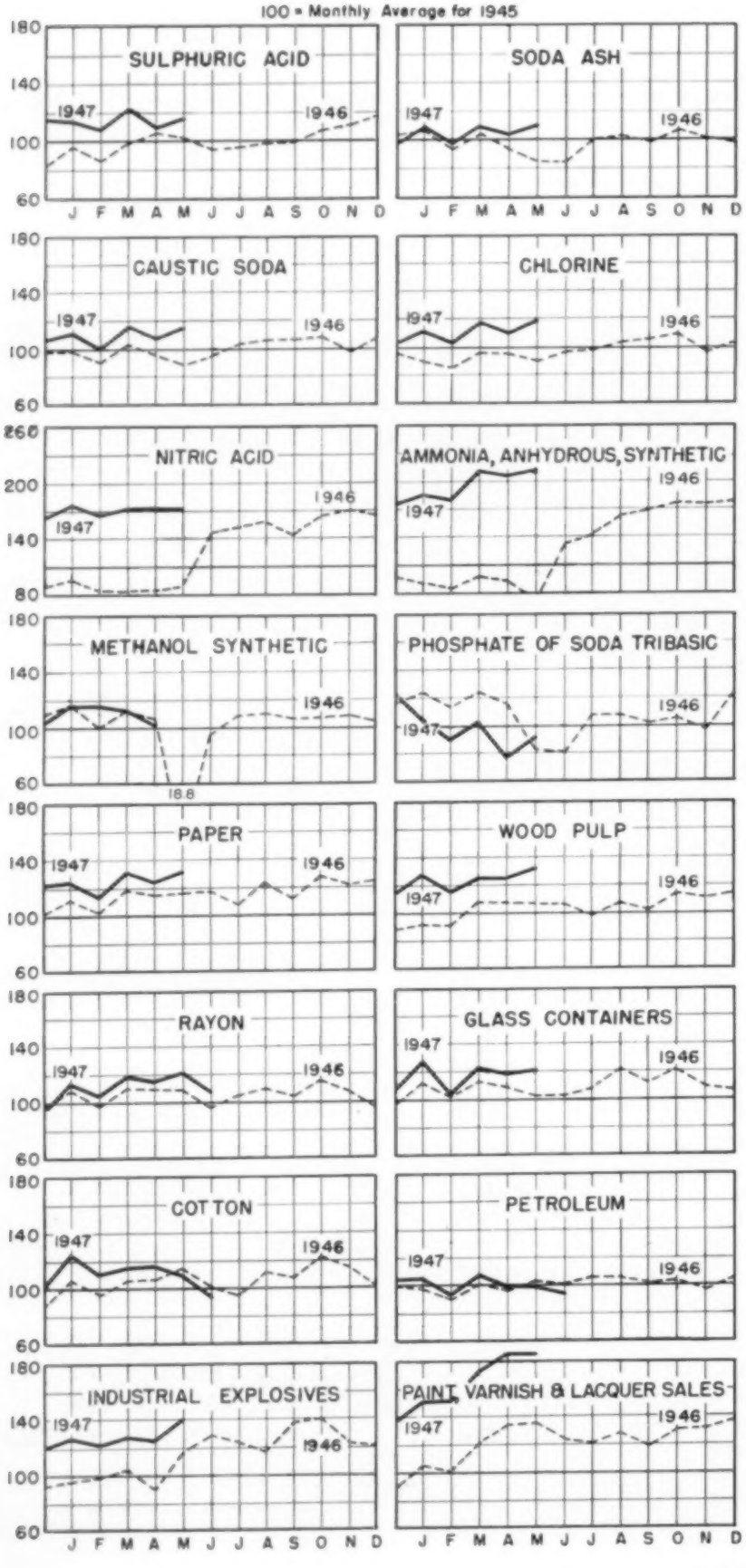
Despite the appearance of warning signals, no material change seems imminent in the position of the industries which are most important as consumers of chemicals. Most of them appear to have leveled off on a currently warranted basis which will continue throughout the third quarter. Some of them have grown so solidly into their present condition that they are almost sure to be recession-proof for a long time to come. This has particular reference to fertilizers which should hold to record levels until such time as world-wide food supplies become normally available. Oil refineries are pushing operations in an effort to meet demands for their products. Only a small part of the backlog of painting requirements has been met and new building, despite difficulties, is bound to be important for some time. Scarcity of oils and fats has caused world-wide shortage of soap. Supplies are becoming more plentiful and soap production is broadening accordingly. The young synthetic detergent industry has forged ahead at an amazing pace and with some backing and filling is slated for a much high level of output.

***Chemical Engineering* Index**
Industrial Consumption of Chemicals
1935 = 100

	April	May
Fertilizers	51.40	53.35
Pulp and paper	22.90	23.60
Petroleum Refining	18.51	19.86
Glass	22.87	23.80
Paint and varnish	27.47	27.42
Iron and steel	13.09	13.40
Rayon	22.11	23.01
Textiles	11.85	11.33
Coal products	9.70	9.99
Leather	4.60	4.50
Industrial explosives	6.74	7.50
Rubber	6.35	5.85
Plastics	7.70	7.08
	225.91	230.69



PRODUCTION AND CONSUMPTION TRENDS



THE CHEMICAL process industries have been going ahead so strongly for months that the upward curve reached at least a temporary peak in May and turned downward with a flattening out probable for the next few months. Predictions of recessions ahead have been heard for a long time but so far general industry and foreign trade have gone on apace. The long-time trend is clouded, with nearby changes expected to be slight in the chemical and related fields.

A mixed trend also is noticed in prices for chemicals with several changes on the downside combined with reports that large segments of the market have shown greater price stability and higher producing costs actually have brought about several upward revisions. In some cases, chemicals remain in small supply and contract prices are firm with sales of spot goods bringing what the tariff will stand.

Production trends of inorganic chemicals continued upward in May. Record production of anhydrous ammonia, chlorine gas, nitric acid and salt cake was achieved. Ammonium nitrate, caustic soda, soda ash, hydrochloric acid, phosphoric acid and sodium carbonate reached near record highs in the same month while sulphuric acid production was 838,194 tons or over 2 percent above April. Fertilizer grade ammonium nitrate production was reported by the Bureau of the Census as 74,554 tons in May and 72,885 tons in April. Computed on an 18 percent basis, superphosphate production in May was 892,139 tons. This is an all time high for this chemical.

The essential oil industry is following with the greatest of interest the developments in Indonesia, where hostilities between the Republicans and the Dutch broke out in the latter part of July. The Dutch East Indies are one of the world's chief sources of supply for essential oils, being suppliers of vietivert, patchouli and citronella, among others. Oil of citronella, in addition to its well-known use as a mosquito-repellent, is used for the production of several isolates and derivatives that are valuable as perfume materials, such as geraniol and hydroxycitronellal. In the first few days following the outbreak of military operations, there was no noticeable price reaction in the essential oil market in this country, probably due to the lack of demand for oil of citronella at the prevailing prices.

Let Trouble be our Introduction

THERE'S nothing like trouble to bring people together. That's how some of Revere's closest friends were gained—through a mutual struggle against difficulties, troubles such as occasionally beset any business.

Take the case of an important product, originally developed for war uses, now finding many applications in peacetime services. When manufacture began, rejections ran extremely high, over 40%, costs were skyrocketing, and badly-needed production was being lost. The maker asked if we would care to collaborate in solving the problem. Of course we would! After studying the subject in detail (and also under conditions of the greatest secrecy), we suggested a radical change in the properties of a non-ferrous metal used in the manufacture of the vital part with which so much trouble was being experienced. New processes of manufacture were developed, and in a short time test runs of the recommended material proved successful. Rejections of finished units dropped to less than 1%. Thus an expensive and vexing bottleneck was broken, and we gained a new customer and a firm friend.

This success story demonstrates that Revere has an open mind as well as an informed one, and is always ready to question the customary, find new answers to new problems, or to old ones, for that matter. If something is worrying you in your employment of non-ferrous metals, get in touch with Revere, not for ready-made answers, but for wholehearted cooperation, a joint search for better results. This help is given freely, without obligation, through the Revere Technical Advisory Service, which has at its command the knowledge and facilities of our laboratories, and the accumulated experience of the entire Revere organization.

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COMPANY
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United States Production of Certain Chemicals

May 1947, May 1946 and Five-Month Totals for 1947 and 1946

Chemicals (tons unless otherwise noted)	May 1947	May 1946	Total, Five Months 1947	Five Months 1946
Ammonia, synthetic, anhydrous[1]	97,107	34,511	453,757	203,262
Ammonium nitrate (100% NH_4NO_3)	89,746	35,597	440,938	179,378
Ammonium sulphate, synthetic, technical (M lb.)	39,076	23,554	156,239	131,920
Calcium arsenate ($Ca_3(AsO_4)_2$) (M lb.)	5,492	3,192	12,341	10,149
Calcium carbide, commercial	56,286	36,761	256,668	208,743
Calcium phosphate: (M lb.)				
Monobasic (100% $CaH_4(PO_4)_2$	3,944	4,867	29,646	28,546
Dibasic (100% $CaHPO_4$)	5,715	4,143	32,035	35,072
Carbon dioxide:				
Liquid and gas (M lb.)	22,913	16,954	87,302	85,123
Solid (M lb.)	73,374	58,197	263,313	241,053
Chlorine	118,284	89,947	556,178[r]	455,699
Chrome green (M lb.)	1,326	1,592	5,852[r]	8,673
Chrome yellow and orange (M lb.)	4,689	3,376	19,190	21,008
Hydrochloric acid (100% HCl)	36,408	26,331	177,146	133,622
Hydrogen (M cu. ft.)	1,650,000	1,202,000	8,051,000[r]	6,895,000
Lead arsenate, acid and basic (M lb.)	3,717	7,810	22,282	38,218
Molybdate chrome orange	344	386	2,027	2,201
Nitric acid (100% HNO_3)	64,826	32,538	320,092	160,640
Oxygen (M cu. ft.)	1,188,000	836,000	5,663,000	3,994,000
Phosphoric acid (50% H_3PO_4)	82,655	67,273	407,975[r]	370,190
Soda ash:				
Ammonia-soda process:				
Total wet and dry[2]	396,282	303,174	1,878,105	1,756,049
Finished light[3]	188,794	150,969	911,299	870,342
Finished dense	147,609	104,055	680,513	617,284
Natural[4]	22,881	17,975	106,237	82,906
Sodium bicarbonate, refined	17,512	14,398	81,024	79,144
Sodium bichromate and chromate	7,474	4,096	34,625	37,679
Sodium hydroxide:				
Electrolytic process:				
Liquid[5]	113,392	87,226	540,740[r]	440,631
Solid	15,982	15,630	95,825	79,371
Lime soda process:				
Liquid[5]	63,750	52,050	317,983	307,833
Solid	20,631	14,740	101,255	91,397
Sodium phosphate:				
Monobasic (100% NaH_2PO_4)	1,174	549	5,878	4,948
Dibasic (100% Na_2HPO_4)	6,927	2,876	31,694	25,900
Tribasic (100% Na_3PO_4)	6,721	6,087	34,344	41,535
Meta (100% $NaPO_3$)	2,490	1,349	11,428	10,978
Tetra (100% $Na_4P_2O_7$)	4,011	4,457	20,446	23,493
Sodium silicate, anhydrous	39,726	29,261	207,998	156,330
Sodium sulphate:				
Anhydrous, refined	10,698	10,560	58,138	83,556
Glauber's salt[4]	17,021	14,592	87,556[r]	68,851
Salt cake, crude, commercial[4]	57,452	47,087	256,656[r]	216,790
Sulphuric acid:[7]				
Chamber process	299,301	339,382	1,418,741	1,277,382
Contact process, new	568,893	468,348	2,750,230	2,310,990
Zinc yellow (zinc chromate) (C.P.)	258	212	1,223	.....

Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census. Production figures represent primary production and do not include purchased or transferred materials. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given data are either confidential or not yet available. [1]Includes a small amount of aqua ammonia. [2]Total wet and dry production, including quantities diverted for manufacture of caustic soda and sodium bicarbonate, and quantities processed to finish light and finished dense. [3]Not including quantities converted to finish dense. [4]Data collected in cooperation with the Bureau of Mines. [5]Figures represent total production of liquid material, including quantities evaporated to solid caustic and reported as such. [6]Includes oleum grades, excludes spent acid. [7]Data for sulphuric acid manufactured as a byproduct of smelting operations are included. [r]Revised.

United States Production of Certain Synthetic Organic Chemicals

April 1947, April 1946 and Four-Month Totals for 1947 and 1946

Chemical	April 1947	April 1946	Total, Four Months 1947	Total, Four Months 1946
Acetanilid	623,340	638,230	2,793,910	2,415,830
Acetic acid:				
Synthetic[1]	28,411,645	23,187,005	121,557,796	89,093,793
Recovered	125,368,376	101,991,404	480,484,562	383,235,782
Natural[2]	1,963,872	2,342,315	8,258,869	7,776,897

(*Continued on page 300*)

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for Chemical Engineering Equipment

★ Copies of *Chemical Engineering's* Twelfth Report on Materials of Construction are now available. This 96-page booklet gives data on 58 materials used in the process industries. It also includes an article on corrosion problems of the Oak Ridge atomic plant and 8 pages of data and information on gaskets and packings..... **$1**

Editorial Department
CHEMICAL ENGINEERING • 330 West 42nd St., New York 18, N. Y.

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United States Production of Synthetic Organic Chemicals

(Continued from page 298)

Chemical	April 1947	April 1946	Total, Four Months 1947	Total, Four Months 1946
Acetic anhydride	53,085,609	44,789,682	202,111,724	172,880,931
Acetone	28,491,656	26,316,490	118,391,318	106,978,271
Acetylsalicylic acid	1,042,728	1,013,525	3,823,606	3,910,160
Aniline	9,319,482	6,624,185	35,943,057	27,707,581
Barbituric acid derivatives[3]				
5-Ethyl-5-phenylbarbituric acid and salts (phenobarbital)	49,254	35,684	149,755	124,956
Benzene:				
Motor grade:				
Tar distillers[4]	695,067	896,596	2,093,667	3,885,460
Coke-oven operators[5]	1,478,552	2,256,879	7,913,093	9,421,712
All other grades:				
Tar distillers[4]	2,244,148	2,379,688	7,050,998	7,598,756
Coke-oven operators[5]	12,403,206	8,739,032	48,939,641	30,150,075
Butyl alcohol primary, normal	13,473,462	8,901,966	36,701,018	34,091,560
Carbon bisulphide	27,672,298	21,909,280	113,736,680	97,627,184
Carbon tetrachloride	14,456,312	10,889,678	65,715,653	48,462,902
Chlorobenzene, mono	23,388,736	23,061,417	96,656,704	86,838,875
Creosote oil:				
Tar distillers[4]	10,667,247	10,068,863	44,340,703	38,157,358
Coke-oven operators[5]	3,604,121	2,386,273	12,245,155	7,825,873
Cresols, meta-para	417,867	748,565	1,781,569	1,727,271
Cresols, ortho-meta-para	1,079,016	491,292	3,112,098	2,505,776
Cresylic acid, refined[7, 10]	2,435,860	2,035,457	8,905,817	6,925,438
Dibutyl phthalate	1,925,313	1,447,909	7,635,333	.....
Dichlorodiphenyltrichloroethane (DDT)	4,397,583	4,139,852	16,711,297	14,231,674
Ethyl acetate (85%)	5,983,662	7,610,358	31,154,910	28,193,176
Ethylene glycol	15,442,681	.....	62,783,261	.....
Ethyl ether	3,371,535	3,486,949	14,396,198	13,110,284
Formaldehyde (37% by wt.)	45,270,852	40,256,656	178,912,257	159,543,924
Hexachlorocyclohexane	335,168	.....	.....	.....
Methanol, natural[8]	1,478,310	1,229,449	5,461,354	5,173,522
Methanol, synthetic	41,210,066	43,932,508	180,432,732	179,964,023
Naphthalene:				
Tar distillers, less than 79° C.	21,073,046	17,660,149	77,780,011	58,828,594
Tar distillers, 79° C. and over	8,854,534	8,634,316	43,534,662	41,354,610
Coke-oven operators, less than 79° C.	9,099,719	5,389,912	30,129,108	18,893,473
Penicillin and salts[9]	2,796,403	2,435,998	11,395,995	7,642,720
Phenol	19,530,745	18,438,959	75,243,143	65,282,587
Phthalic anhydride	9,604,982	9,216,851	43,828,969	35,149,262
Styrene, government and private plants	20,329,648	.....	112,428,745	.....
Toluene:				
Coke-oven operators	2,423,432	1,465,272	8,906,425	5,458,168
All other[9]	2,281,156	1,010,581	10,922,562	4,189,081
Xylene, from coal tar and petroleum	3,962,417	.....	17,056,491	.....

All data in pounds except benzene (gal.) creosote oil (gal.), toluene (gal.) xylene (gal.) and penicillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential. [1]Excludes the statistics on recovered acid. [2]Acid produced by direct process from wood and from calcium acetate. [3]All acetic anhydride including that from acetic by vapor-phase process. [4]Product of distillers who use purchased coal tar only or from oil-gas or water-gas produced or purchased by tar distillers. [5]Statistics are given in terms of bulk medicinals only. [6]Statistics collected by Bureau of Mines. [7]Total production including data reported both by coke-oven operators and by distillers of purchased coal tar. [8]Reported to U. S. Bureau of the Census. [9]Includes toluene produced from petroleum by any process. [10]Includes refined cresylic acid from petroleum.

1946 Production of Coal Tar Chemicals at Byproduct-Coke Plants

Bureau of Mines Data

Product		Production	Sales Quantity	Sales Av. Value
Tar	gal.	596,868,745	377,998,582	$0.038
Tar derivatives:				
Creosote oil, distillate as such	gal.	20,785,839	20,474,218	.124
Creosote oil, in coal tar solution	gal.	10,336,986	9,063,960	.135
Tar acid oil	gal.	12,953,198	13,270,360	.122
Pitch of tar:				
Soft	tons	303,087	131	12.870
Hard	gal.	207,403	176	8.460
Other tar derivatives		.....	.....	.....
Ammonia:				
Sulphate	lb.	1,287,504,417	1,284,471,366	0.014
Liquor (NH_3 content)	lb.	49,982,452	47,042,597	.030
Sulphate equivalent of all forms	lb.	1,487,434,225	1,472,641,754	.....
NH_3 equivalent of all forms	lb.	371,858,556	368,160,439	.....
Gas:				
Used under boilers	M cu. ft.	.....	29,473,813	.112
Used in steel or affiliated plants	M cu. ft.	.....	265,545,711	.117
Distributed through city mains	M cu. ft.	783,637,016	157,234,511	.285
Sold for industrial use	M cu. ft.	.....	28,235,551	.134
Light oil and derivatives:				
Crude light oil	gal	206,914,333	13,199,230	.080
Benzol:				
Motor	gal.	27,398,806	29,146,443	.088
All other grades	gal.	109,728,963	110,378,789	.129
Toluol, crude and refined	gal.	16,519,763	16,136,385	.205
Xylol, crude and refined	gal.	5,986,250	5,869,310	.227
Solvent naphtha	gal.	4,401,158	4,105,059	.129
Other light oil products	gal.	7,572,226	5,911,018	.098
Total	gal.	171,607,226	184,796,234	.128
Naphthalene, crude	lb.	71,605,138	71,769,750	.022
Pyridine:				
Crude	gal.	329,661	362,928	.866
Refined	gal.	95,343	107,857	3.311
Picoline	gal.	25,412	39,888	1.673
Sodium phenolate	gal.	2,448,547	2,385,342	0.063

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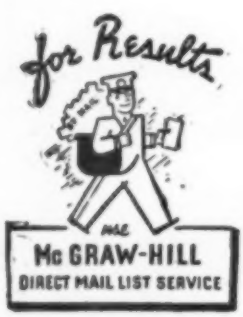

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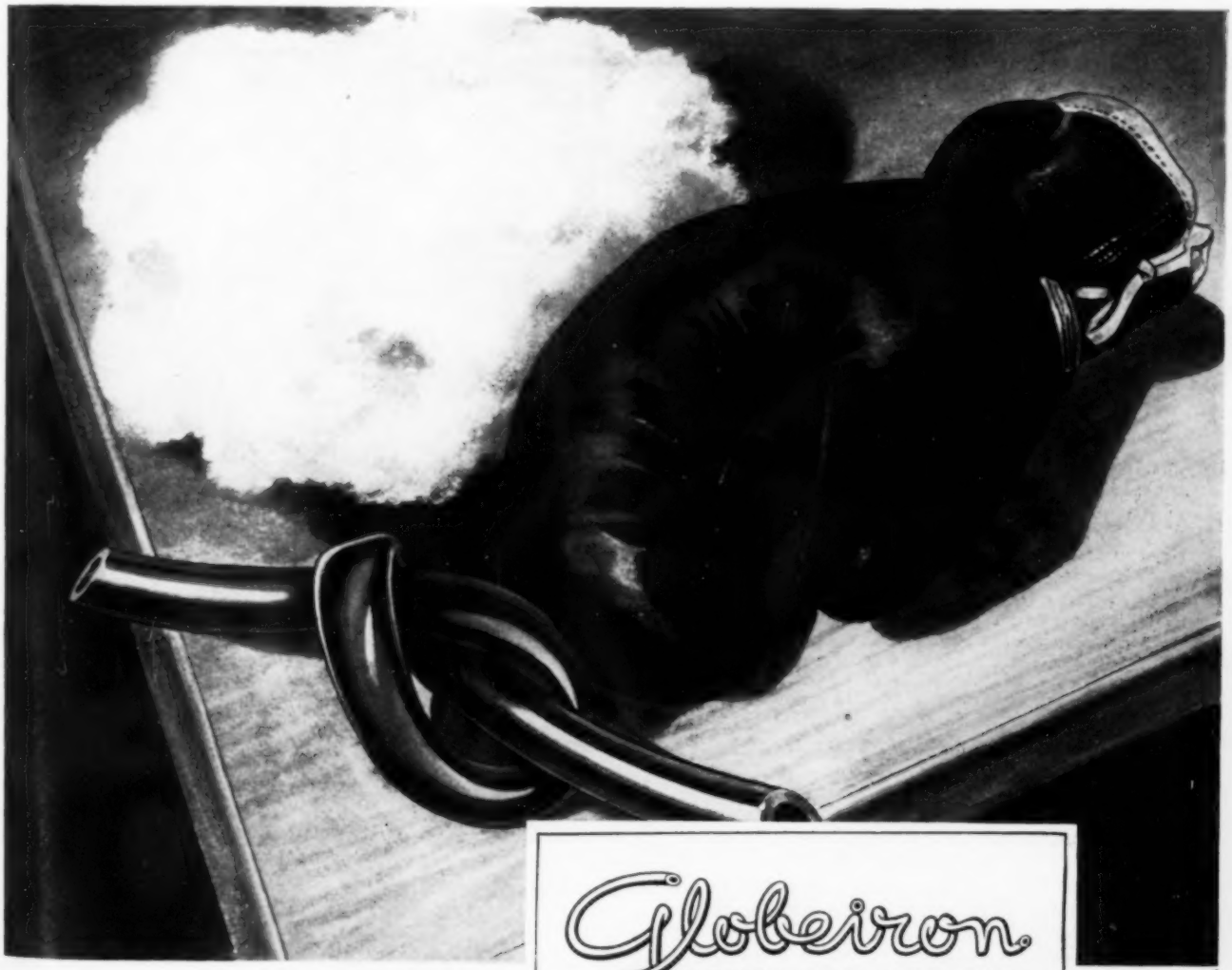

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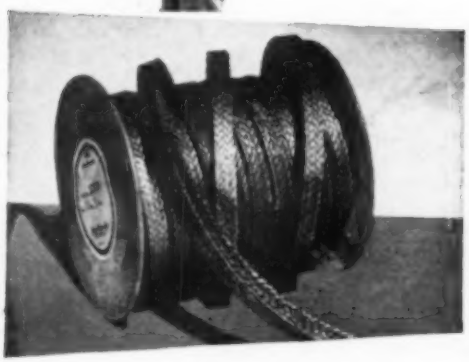

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PACKINGS & GASKETS

CHEMICAL ENGINEERING
Weighted Index of Prices for CHEMICALS

Base = 100 for 1937

As of August 1	**122.17**
Last month (Revised)	123.23
August, 1946	111.36
August, 1945	108.75

CURRENT PRICES

The accompanying prices refer to round lots. Where it is trade custom to sell f.o.b. works, quotations are so designated. Prices are corrected to August 7.

INDUSTRIAL CHEMICALS

Acetone, tank, lb	$0.07 - $0.09
Acid, acetic, 28%, bbl., 100 lb	3.78 - 4.03
Boric, bbl., ton	119.00 -123.00
Citric, drums, lb	.24½ - .26
Formic, cbys., lb	.12 - .12½
Hydrofluoric, 30%, drums, lb	.08 - .085
Lactic, 44% tech., light, bbl., lb	.0815- .0855
Muriatic 18°, tanks, 100 lb	1.00 -
Nitric, 36°, carboys, lb	.05 - .05½
Oleum, tanks, wks., ton	19.50 - 20.00
Oxalic, crystals, bbl., lb	.13 - .14
Phosphoric tech., tanks, lb	.0465-
Sulphuric, 60°, tanks, ton	13.00 -
Tartaric, powd., bbl., lb	.49½ - .50
Alcohol, amyl from pentane, tanks, lb	.151-
Alcohol, butyl, tanks, lb	.14½ - .29
Alcohol, ethyl, denatured, No. 1 special tanks, gal	.87½-
Alum, ammonia, lump, lb	.04½-
Aluminum sulphate, com. bags, 100 lb	1.15 - 1.25
Ammonia, anhydrous, cyl., lb	.16 - .20
tanks, ton	59.00 - 61.50
Ammonium carbonate, powd., casks, lb	.09½ - .10
Sulphate, wks, ton	30.00 - 35.00
Amyl acetate, tech. from pentane, tanks, lb	.21 -
Aqua ammonia, 26°, drums, lb	.03 - .03½
tanks, ton	65.00 -
Arsenic, white powd., bbl. lb	.06 - .07
Barium carbonate, bbl., ton	67.50 - 75.00
Chloride, bags, ton	85.00 - 90.00
Nitrate, casks, lb	.11½ - .12
Blanc fixe, dry, bags, ton	67.50 - 72.50
Bleaching powder, f.o.b. wks., drums, 100 lb	2.75 - 3.00
Borax, gran., bags, ton	48.50 -
Calcium acetate, bags, 100 lb	3.00 -
Arsenate, dr., lb	.09½ - .10
Carbide, drums, ton	50.00 -
Chloride, flake, bags, del., ton	21.50 - 38.00
Carbon bisulphide, drums, lb	.05 - .05½
Tetrachloride, drums, lb	.06½ - .07
Chlorine, liquid, tanks, wks., 100 lb	2.00 - 2.30
Copperas, bgs., f.o.b., wks., ton	17.00 - 18.00
Copper carbonate bbl., lb	.24 - .27
Sulphate, bags, 100 lb	7.60 - 7.75
Cream of tartar, bbl., lb	.41½ - .42
Diethylene glycol, dr., lb	.14 - .15
Epsom salt, dom., tech., bbl., 100 lb	2.05 - 2.25
Ethyl acetate, tanks, lb	.09½ - .16
Formaldehyde, 30%, dr., wks., lb	.0545-
Furfural, tanks, lb	.09½ -
Glaubers salt, bag, 100 lb	1.25 - 1.50
Glycerine, c. p., drums, extra, lb	.29½ - .30
Lead:	
white, basic carbonate, dry casks, lb	.15½-
Red, dry, sck., lb	.18 -
Lead acetate, white crys., bbl., lb	.19½ - .20½
Arsenate, powd., bags, lb	.21½ - .22
Lithopone, bags, lb	.05½ - .06
Magnesium carb., tech., bags, lb	.07½ - .08
Methanol, 95%, tanks, gal	.60 -
Synthetic, tanks, gal	.24 - .29
Phosphorus, yellow, cases, lb	.22 - .25
Potassium bichromate, bags, lb	.10½ - .10¾
Chlorate, powd., lb	.09 - .09½
Hydroxide (c'stic potash) dr., lb	.07½ - .09½
Muriate, 60%, bags, unit	.37½-
Nitrate, ref., bbl., lb	.08½ - .21
Permanganate, drums, lb	.20½ - .21½
Prussiate, yellow, casks, lb	.19 - .20
Sal ammoniac, white, casks, 100 lb	4.75 - 5.00
Salsoda, bbl., 100 lb	1.10 - 1.20
Salt cake, bulk, ton	20.00 -
Soda, ash, light, 58%, contract, bags, 100 lb	1.20 -
Dense, bags, 100 lb	1.28 -
Soda, caustic, 76% solid, drums, 100 lb	2.60 -
Acetate, del., lb	.05½ - .06
Bicarbonate, bags, 100 lb	2.25 -
Bichromate, bags, lb	.08½ - .08¾
Bisulphate, bulk, ton	20.00 - 24.00
Bisulphite, bbl., lb	.03 - .04

CHEMICAL ENGINEERING

Weighted Index of Prices for OILS & FATS

Base = 100 for 1937

As of August 1	222.95
Last month	220.34
August, 1946	166.39
August, 1945	145.85

Chlorate, kegs, lb	$0.06½	$0.06¼
Cyanide, cases, dom., lb	.14½	.15
Fluoride, bbl., lb	.09½	.09¼
Hyposulphite, bags, 100 lb	2.25	2.50
Metasilicate, bbl., 100 lb	3.40	4.00
Nitrate, bulk, ton	32.00	38.50
Nitrite, casks, lb	.06½	.07
Phosphate, tribasic, bags, 100 lb	3.50	.....
Prussiate, yel., bags, lb	.12	.12½
Silicate, 40°, dr., wks., 100 lb	.95	1.00
Sulphite, crys, bbl., lb	.02½	.02¼
Sulphur, crude at mine, long ton	16.00	18.00
Dioxide, cyl., lb	.085	.09
Dioxide, tanks, lb	.044	.....
Tin crystals, bbl., lb	.55	.....
Zinc chloride, gran., bbl., lb	.07	.07½
Oxide, lead free, bags, lb	.09½	.09¾
Oxide, 35%, leaded, bags, lb	.11½	.11¾
Sulphate, bags, cwt	4.15	7.00
OILS AND FATS		
Castor oil, No. 3 dr., lb	$0.26	.....
Chinawood, oil, tanks, lb	.25	.....
Coconut oil, ceylon, N. Y., lb	.12	.....
Corn oil, crude, tanks, (f.o.b. mill), lb	.23	.....
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.22	.....
Linseed oil, raw, car lot, dr., lb	.294	.....
Palm, casks, lb	nom.	
Peanut oil, crude, tanks (mill), lb.	.21	.....
Rapeseed oil, refined, bbl., lb	nom.	
Soybean, tanks, lb	.18	.....
Menhaden, light, pressed dr., lb.	.23	.....
Crude, tanks (f.o.b. factory), lb.	nom.	
Grease, yellow, loose, lb	.10¼	.....
Oleo stearine, lb	nom.	
Oleo oil, No. 1, lb	.18	.....
Red oil, distilled, bbl., lb	.18½	.....
Tallow, extra, loose, lb	.11¼	.....
COAL TAR PRODUCTS		
Alpha-naphthol, crude, bbl., lb	$0.58	$0.60
Alpha-naphthylamine, bbl., lb	.35	.36
Aniline oil, drums, lb	.13	.13¼
Aniline salts, bbl., lb	.22	.24
Benzaldehyde, tech., dr., lb	.45	.50
Benzidine base, bbl., lb	.75	.77
Benzoic acid, USP, kegs, lb	.54	.56
Benzol, 90% tanks, works, gal	.19	.....
Benzyl chloride, tech., dr., lb	.20	.21
Beta, naphthol, tech., drums, lb	.23	.24
Cresol, USP, dr., lb	.13½	.....
Cresylic acid, dr., wks., gal	1.00	1.05
Diphenyl, bbl., lb	.16	.....
Diethylaniline, dr., lb	.48	.50
Dinitrotoluol, bbl., lb	.18	.19
Dinitrohenyl, bbl., lb	.22	.23
Dip oil, 15%, dr., gal	.23	.25
Diphenylamine, dr., f.o.b. wks., lb.	.25	.....
H acid, bbl., lb	.50	.52
Hydroquinone, bbl., lb	.90	.95
Naphthalene, flake, bbl., lb	.11	.11¼
Nitrobenzene, dr., lb	.08½	.09
Para-Cresol, bbl., lb	.41	.....
Para-nitroaniline, bbl., lb	.42	.43
Phenol, USP, tanks, lb	.10½	.11
Picric, acid, bbl., lb	.30	.32
Pyridine, dr., gal	1.55	1.60
Resorcinol, tech., kegs, lb	.68	.70
Salicylic acid, tech., bbl., lb	.26	.27
Solvent naphtha, w. w., tanks, gal.	.25	.....
Toluidin, bbl., lb	1.00	.....
Toluol, drums, works, gal	.23	.....
Xylol, com., tanks, gal	.25	.....
MISCELLANEOUS		
Casein, tech., bbl., lb	$.28	$.30
Dry colors:		
Carbon gas, black (wks.), lb	.04	.07
Prussian blue, bbl., lb	.42	.43
Ultramarine blue, bbl., lb	.13	.24
Chrome green, bbl., lb	.31	.40
Carmine red, tins, lb	5.50	6.00
Para toner, lb	.80	.95
Vermilion, English, bbl., lb	2.50	2.70
Chrome yellow, C. P., bbl., lb.	.26	.28
Gum copal, Congo bags, lb	.09	.55
Manila, bags, lb	.09	.15
Damar, Batavia, cases, lb	.10	.22
Kauri, cases, lb	.18	.60
Magnesite, calc., ton	60.00	.....
Pumice stone, lump, bbl., lb	.05	.07
Resin, H., 100 lb	8.05	.....
Shellac, orange, fine, bags, lb	.55	.57
Bleached, bonedry, bags, lb	.58	.60
T. N. bags, lb	.54	.55
Turpentine, gal	.75	.....

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NEW CONSTRUCTION

	Current Projects		Cumulative 1947	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	$55,000	$55,000	$9,016,000	$2,431,000
Middle Atlantic	220,000	4,507,000	7,062,000	21,331,000
South	25,512,000	30,488,000	36,873,000	40,568,000
Middle West	55,000	1,824,000	16,503,000	15,995,000
West of Mississippi	21,178,000	12,726,000	252,590,000	84,121,000
Far West	255,000	715,000	4,461,000	11,756,000
Canada	5,660,000		57,506,000	17,680,000
Total	$52,935,000	$51,315,000	$384,011,000	$193,882,000

Contracts Awarded

Del., Wilmington—E. I. du Pont de Nemours & Co., Inc., du Pont Bldg., has awarded the contract for a pigment building, Project 4214, to J. A. Bader & Co., Inc., 932 Market St. Estimated cost $372,938.

Ga., Atlanta—Alston-Lucas Paint Co., c/o Southern Concrete Products Co., contractor, 1108 Chattahoochee Ave., N. W., will construct the first unit of a paint manufacturing plant. Estimated cost $90,000.

Ill., Chicago—Carborundum Co., 3630 South Iron St., has awarded the contract for a top addition to its factory to Carl E. Erickson Co., 4657 Ravenswood Ave. Estimated cost $180,000.

La., Lake Charles—Cities Service Refinery Corp. & Continental Oil Co., Lake Charles, have awarded the contract for a lubrication plant for Citcon Corp., to Lummus Co., 420 Lexington Ave., New York 17, N. Y. Estimated cost $30,000,000.

Ia., Red Oak—National Carbon Co., Cleveland, O., has awarded the contract for a battery factory to Gilmore-Carmichael & Olson Co., 1873 East 55th St., Cleveland. Estimated cost $1,000,000.

Kan., Wichita—Barco Oil Co., 424 South Chey St., Tulsa, Okla., has awarded the contract for modernizing and enlarging its refinery here to Koch Engineering Co., Wichita. Estimated cost $260,000.

Md., Cumberland—Celanese Corp. of America, Cumberland, has awarded the contract for an addition to its Amselle Plant to Geo. Hazelwood Co., Howard St. Estimated cost $75,000.

Mich., Grand Rapids—Wood Finishing Materials Co., 839 Iroquois St., S. E., has awarded the contract for a lacquer products plant to Osterink Construction Co., 1502 Grandville St., S. W. Estimated cost $60,000.

Mich., Midland—Dow Chemical Co., Midland, has awarded the contract for an addition to its chemical manufacturing plant to The Austin Co., 227 Curtis Bldg., Detroit. Estimated cost $130,000.

Mo., St. Louis—Staley's Renew-It Finishes Co., 5243 Manchester Ave., has awarded the contract for an addition to its paint factory to S. P. Shakofsky Construction Co., 1062 Purdue Ave., University City, St. Louis.

Mont., Billings—Carter Oil Co., subsidiary of Standard Oil Co. of New Jersey, Billings has awarded the contract for an oil refinery to Fluor Corp., Ltd., P. O. Box 7030, Los Angeles, Calif. Estimated cost $1,341,000.

N. J., Salem—Anchor Hocking Glass Co., 82 Griffith St., has awarded the contract for alterations to Plant No. 6 to Jack S. Steele Co., Commercial Trust Bldg., Philadelphia, Pa. Estimated cost $130,000.

N. Y., East Greenbush—Mutual Life Insurance Co. of New York, 34 Nassau St., New York, N Y., has awarded the contract for a 4 story research laboratory divided into wings for chemical and biological research and for administration to Grove, Shepherd, Wilson & Krug, 247 Park Ave., New York, N. Y. Estimated cost $3,000,000.

N. Y., Newburgh—E. I. du Pont de Nemours & Co., Inc., du Pont Bldg., Wilmington, Del., has awarded the contract for a research laboratory here to B. M. Higginson, Inc., 248 Broadway, Newburgh. Estimated cost $205,000.

N. Y., Syracuse—Church & Dwight Co., Inc., 1416 Willis Ave., has awarded the contract for a new chemical process building to The Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost $125,000.

N. C., Marshville—Carolina-Asbestos Co., Marshville, has awarded the contract for an addition to its plant to Interstate Construction Co., 2028 South Boulevard, Charlotte. Estimated cost $97,500.

O., Baltimore—Fairfield Paper Co., Fairfield, has awarded the contract for an addition to its plant to The Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost $265,000.

O., Bedford—Ferro Chemical Corp., Northfield and Forbes Rds., has awarded the contract for an addition to its chemical plant to Leo W. Schmidt, 1000 Granger Rd., Garfield Heights, O. Estimated cost $60,000.

O., Cleveland—Anchor Rubber Products Co., 1725 London Rd., has awarded the contract for an addition to its plant to Norge Construction Co., 1742 East 23rd St. Estimated cost $129,000.

O., Ironton—Barrett Div. of Allied Chemical Co., Margaret and Bermuda Sts., Philadelphia, Pa., has awarded the contract for a chemical plant to Wigton-Abbott Corp., 1225 South Ave., Plainfield, N. J. Estimated cost $1,000,000.

Okla., Tulsa—Mid Continent Petroleum Corp., Mid Continent Bldg., has awarded the contract for enlarging its refinery to M. W. Kellogg Co., Philtower Bldg., Tulsa. Estimated cost $3,400,000.

Pa., Bristol—Rohm & Haas Co., 222 West Washington St., Philadelphia, has awarded the contract for an addition to Bldg. No. 63, to Frank V. Warren, Inc., 225 South 15th St., Philadelphia. Estimated cost $98,550.

Pa., Kabuta (Monaco P. O.)—Koppers Co., Koppers Bldg., Pittsburgh, will construct three new buildings and three additions to polysterene plant. Work will be done by owner. Estimated cost $500,000.

R. I., Valley Falls—Guyan Mills, Inc., Havens St., has awarded to contract for a 2 story rayon mill to Henry Soule, 110 Armistice Blvd., Pawtucket. Estimated cost $55,000.

Tenn., Columbia—Monsanto Chemical Co., Columbia, has awarded the contract for an addition to its plant to Batson-Cook Co., West Point, Ga. Estimated cost will exceed $100,000.

Tex., Beaumont—Southern Acid & Sulphur Co., 7621 Wallisville Rd., Houston, will enlarge its plant here. Work will be done by subcontracts. Estimated cost $170,000.

Tex., Dallas—Lone Star Gas Co., 1915 Wood St., will construct compressor station units and additions to its gasoline plant. Estimated cost $640,000 and $375,000 respectively.

Tex., Houston—Humble Oil & Refining Co., Humble Bldg., has awarded the contract for a warehouse and office building, a raw products storage warehouse and a varnish factory to H. K. Ferguson Co., M & M Bldg. Estimated cost $318,000, $86,225 and $76,000 respectively.

Tex., Smith's Bluff—Pure Oil Co., N. Esperson Bldg., Houston, will improve and enlarge its refinery. Work will be done with force account and subcontracts. Estimated cost $265,000.

Tex., Texas City—Carbide & Carbon Corp., Texas City, has awarded the contract for a 2 story addition to its chemical plant to Ford, Bacon & Davis, Texas City. Estimated cost $240,000.

Tex., Texas City—Monsanto Chemical Co., Texas City, has awarded the contract for reconstructing its chemical plant here to Leonard Construction Co., 37 South Wabash St., Chicago, Ill., and W. S. Bellows Construction Co., 716 North Everton St., Houston. Estimated cost $3,500,000 and $1,000,000 respectively.

W. Va., Natrium—Columbia Chemical Div. of Pittsburgh Plate Glass Co., 4337 Fifth Ave., Pittsburgh, Pa., has awarded the contract for two manufacturing buildings to Eichleay Engineering Co., 33 South 10th St., Pittsburgh. Estimated cost $200,000.

Wash., Seattle—Monsanto Chemical Co., St. Louis, Mo., has awarded the contract for additions to its plant to Howard S. Wright & Co., 407 Yale Ave., N., Seattle. Estimated cost $715,000.